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The War and the Electrical Industry

THE COUNTRY is in a state of war. For over two years and a half we have been neutral spectators of the greatest conflict in history, watching it spread like a conflagration both in fury and scope until at last reluctantly but irresistibly we have been drawn into the maelstrom of the fight. In his masterly address to Congress the President has set forth the many acts of ruthlessness which have provoked our peace-loving country into a militant defender of national honor and international law.

In our firm belief in triumph through the justice of our cause we must not lose sight of the fact that our autocratic opponent has clearly shown that he possesses an organized war machine of almost diabolical efficiency which after thirty-two months of the most furious fighting ever known is by no means yet conquered. Our entrance into the combat may for some time have no material effect on the fortunes of the war. While everyone hopes for an early and enduring peace, it would be rank folly to assume that our participation will immediately insure this desirable result. It is clearly the part of wisdom, therefore, to make every possible preparation, speedily but intelligently, as if we were entering on a very long and very bitter war, in which all classes of citizens and all industries must do their share in national service.

The electrical industry is ready to perform its tasks and eager for the opportunity to serve. The call of the hour is for the most effective and efficient service in this national crisis, and our national organizations, like the American Institute of Electrical Engineers, the National Electric Light Association, the Jovian Order, are co-operating with the government to determine what are the most effective tasks for the various branches of the industry. The first impulse is to urge enlistment of men for general military and naval service, where they certainly are sorely needed. Even this should be done intelligently. The Army and Navy need men not only for fighting in the ranks and aboard ship but they also need many men specially trained for radio and telephone service, for operating and maintaining generators, motors, searchlights, ordinary electric lighting circuits, and the great variety of electrical equipment used in modern warfare. Those men who can be spared from the electrical industry should therefore be encouraged to enlist for those branches of the fighting organization where their services will prove of most value. That promotion of enlistment for such special service will be heartily appreciated is shown by the following letter received by the editor from the Secretary of the Navy:

> Navy Department, Washington,
> April 3, 1917.
>
> My dear Sir:
>
> The Department desires to express its hearty appreciation of the excellent article appearing in your March 31st issue of the ELECTRICAL REVIEW, entitled "Electrical Opportunities in the Navy," accompanied by numerous halftones of scenes pertaining to electrical work in the Navy. This article will undoubtedly aid in arousing interest in the many opportunities the Navy offers young electricians.
>
> Respectfully,
> JOSEPHUS DANIELS.

An effective fighting organization needs a great quantity and variety of supplies, food, clothing, weapons, ammunition, tools, etc., to keep it in efficient condition. The production of these supplies imposes a large task on manufacturers, as well as on farmers, miners and other producers of raw materials. Electrical manufacturers are in excellent condition to serve the country to whatever extent is necessary in the manufacture of munitions and other necessities of war. Their plants are being placed at the disposal of the government for this purpose.

Central stations, in their turn, are ready and anxious to increase their supply of power to the manufacturers, especially those working on government contracts, in order that the latter may concentrate their facilities for the production of munitions with less cost and delay than could be involved in securing the added power by installation or enlargement of isolated power plants. Through their supply of reliable and economical power the central stations are rendering a most important service to the nation's industries and therefore form an essential element in the national defense.

Telephone and telegraph companies likewise are vital links in the national program, since prompt and dependable communication must be available for the

marshalling of the country's man power and industries. These companies are freely co-operating with the government in every possible way. Naturally all these utilities must be maintained at maximum efficiency and this becomes a serious problem to the management if the trained personnel is largely drafted into military service.

It is evident that every branch of the industry must develop its efficiency to the utmost, eliminate waste, utilize personnel and materials to the best advantage, and freely co-operate with the government in bringing about success in the gigantic struggle in which we have become involved. The electrical industry will not be found wanting in loyalty to the country in which it has been privileged to make such rapid strides.

Clearance and Station Efficiency

IT is a difficult task to establish a direct connection between clearance allowances and plant efficiency, but the relation cannot be ignored in any close study of operating economy. Reduced first cost of building and also of piping and wiring accompanies short spacing within a plant, and narrow passageways correspond in a degree at least to lower fixed charges than spacious layouts. Clearance costs heavily in plants where the value of real estate is high and yet is it not worth the cost in most instances when one regards the operation of the plant from the safety point of view? We think it is justifiable to allow ample clearances in every feasible case, even if the first cost is thereby somewhat increased, and believe that operating men will sustain this opinion.

To attempt to specify what clearances should invariably be used in different parts of a station is beyond the scope of these comments. It would be about as satisfactory as trying to specify the kind of cloth and price of a suit of clothes destined to meet the needs of a dozen men picked at random from the street. But no engineer who has had operating experience under the handicaps of closely restricted space will advocate a penny-wise policy in laying out plant equipment in future. There was a time when an 18-inch clearance between the back of a 600-volt switchboard and the nearest wall of the engine room was looked upon as the height of liberality on the part of the station designer. There may be instances today where this spacing is all that can be permitted, but wholly apart from the theoretical safe clearances between conductors or between conductors and station operators under normal conditions is the question of freedom of movement in times of stress, relation of breaking contacts to drafts from adjacent doorways, and accessibility of plant details for inspection or repair requiring special tools, etc.

Not a little good can be accomplished by beginning the compilation of practical clearance data in the notebook of the engineer, with brief entries as to the latter's opinion of prevailing dimensions.

Inadequate clearance certainly increases the labor requirements of a plant, even if it adds no more men to the payroll. Time is lost in passing from one part of such a station to another, and in emergencies the fraction of a minute may sometimes be worth many times the cost of having provided an initial layout suitable for quick work. The more dodging about there is in a station the less chance there is for the proper steps to be immediately taken in case of trouble, and if the lighting facilities fail temporarily, the situation becomes still worse. Time is also lost in the detection of localized troubles of minor character in plants where the equipment is crowded into the space available. When it comes to repairs, the task of the engineer is sometimes well nigh hopeless, and the cost of removing apparatus of moderate weight may be increased many per cent in both time and money by a niggardly policy in the layout of the original plant or of its extensions.

It is in connection with these last that the engineer of today will find his best opportunity to overcome the ill effects of the past in respect to cramming the plant. Let him make a stiff fight for liberal space allowances in all new work, bearing in mind the probabilities of further increases of load and of equipment size. Accessibility is one of the most valuable features any station as a complete plant can possess, and a little extra money expended on clearances will pay a handsome interest in years to come through its effect on maintenance and operating convenience.

Significance of Operating Factors

THE third and last installment of Mr. Croft's article on "Operating Factors" appears in this issue. In this article Mr. Croft points out clearly the bearing of the several factors discussed upon the efficient operation of a central station.

Load curves are necessary before any of the operating factors can be derived. These load curves may or may not be of value depending upon their analysis and interpretation. Every central station is anxious to increase the number of customers or load, but unless a careful analysis of the load curve of the new consumer's installation is made, its addition may prove a liability instead of an asset. It is obvious that if the maximum demand of the connected load is near the full capacity of the plant, the addition of a new load, the time of whose maximum demand coincides with the time of the maximum demand of the connected load, may necessitate the installation of additional apparatus and result in a decrease in the plant-factor. On the other hand, a load whose peak does not coincide with the peak of the connected load when added will increase both the load-factor and the plant-factor, and is, therefore, very desirable. To solicit a load of the first class at the old rates is evidently not advantageous, while a comparatively excessive outlay may be justified in securing a load of the second class. A valuable feature of Mr. Croft's article is the detailed explanation of load-curve analysis.

The application of these principles by plant superintendents and new-business men will in many instances disclose misdirected effort and means for improving the factors of operation.

Women in English Electricity Works

SINCE we last referred in these pages to the various classes of service which women were rendering in British electrical industry and undertakings of a public utility character, the movement in this direction has grown very considerably. Such is the case both in respect to the number employed and in regard to the classes of service. It is hardly necessary to allude to their employment as conductors and even "motormen" on electric street cars, and as "trainmen" on the electric railways, as this class of service has become fairly general for them in all belligerent countries, though it may be remarked that they are not always successful as drivers of street cars on account of their lack of physical strength for operation of hand-operated brakes. Nor is it necessary to say much concerning their service in factories where winding, lamp-making and manifold small accessory operations are being performed; here naturally their activities are as great as, or greater than, ever before.

The chief interest of the present moment centers in their employment in electric generating plants and substations, and in the various other capacities—distribution and installation work, for example—connected with these public utility undertakings. Some time ago we discussed the shortage of central-station assistants in England consequent upon a large number of them voluntarily joining the fighting or special technical forces; when compulsory service came, further drafts were sent, especially of the younger men and of others from some of the stations or systems which were not essential from the standpoint of war. In February, this year, as the calling up of all fit men for military service was proceeded with, the government authorities responsible for deciding the relative values of different classes of activity from the national point of view, issued a full memorandum to electricity works warning them that more of their men would have to be taken and giving them advice as to the best lines along which they should proceed with the work of substitution.

Fortunately there is now a good deal of experience to go upon, and the employment of women has proved to be perfectly satisfactory for many of the jobs that have to be done in, or in connection with, an electricity works. In one large station as many as twenty-one women are now employed, and many might be mentioned where smaller numbers have done quite well when they have been women of the right type. Of course, in addition to securing female assistance, recourse is being had to the employment of disabled soldiers who have had no previous electrical experience save a few weeks' special training either while in or after leaving the military hospitals. The Institution of Electrical Engineers and some of the technical institutes have done excellent service in this connection. Efforts have also been made to secure medically unfit men for such work so that physically fit fighting men could be released. It is suggested by the authorities that this part of the procedure should be continued and extended, and it will also be possible for men who are now with the forces but are in low medical categories to be brought back to the stations formerly employing them so that the young and better physically fit men may undertake active military duty.

The whole position is naturally a very difficult and complicated one for the industry as a whole, but as it is tackled separately by each individual management the process will become simplified. Disabled soldiers are found to be capable of acting as assistant switchboard attendants after a moderate amount of training, and in smaller stations as full switchboard attendants. It is advised by the government department concerned with the matter that both in generating stations and in larger substations which require constant attendance "superior type" of women should be engaged if available, preferably those who have had some scientific training. In large stations where two or three attendants or more are engaged on each shift, it will be necessary to have, as charge hand on each shift, a skilled male attendant; but the junior switchboard attendants, it is held, could readily be replaced by "suitable" women. "Normally, junior attendants are youths who undertake such work for a time, in order to gain practical switchboard experience, as a stepping stone to the position of electrical engineer." One interesting recommendation, which no doubt will meet with ready approval from the displaced men who wonder what will happen to them when they return if their places are then occupied, is that in substations which ordinarily require the presence of only one man, two women should be substituted, "in view of the possibility that a woman working alone may, in case of emergency, lose her presence of mind." Emphasis is laid on the desirability of employing disabled soldiers and sailors for such work, after careful selection and training, in preference to women.

For meter-testing again, women of a "superior type" are advised. They would require a long preliminary training before they could undertake such work unaided, but they could act as useful assistants during their training. It is considered that ordinary working women could do good work in the cleaning of stations and machinery (high-speed turbogenerators) where cleaning operations are simpler and safer than in older stations where machinery is not inclosed and parts are difficult of access. Suitably clothed and with proper appliances they are capable of cleaning even these more difficult plants *whilst at rest*. It is not felt that there is large scope for them in modern boiler houses where coal and ash handling and stoking are mechanical, but in smaller stations by using small barrows they can do ash wheeling and cleaning up.

It will be observed from the foregoing that women are being found a place in electricity systems that they probably never would have occupied in England under ordinary circumstances.

HAPPENINGS IN THE INDUSTRY

President Wagner Offers Services of National Electric Light Association to Government—Fuel Oil Seen as Substitute for Coal—Plans for Ohio Electric Light Association Convention—Hydroelectric Possibilities of the South—Jovians Want Lincoln Highway Lighted—Miscellaneous News Notes

PRESIDENT WAGNER OFFERS SERVICES OF NATIONAL ELECTRIC LIGHT ASSOCIATION TO GOVERNMENT.

Believes Electricity Will Play a Very Important Part in Preparations for and Conduct of War and Electrical Industry Is Ready to Serve.

President H. A. Wagner, of the National Electric Light Association, believing that electricity will play a very important part in the preparations for and conduct of the war in which we are about to enter, has officially tendered the services of the National Electric Light Association to the Government.

In a communication to the Secretary of War, President Wagner made the following statement:

"My attention has been called to letters written to you under date of February 28 and March 7, by Dr. Dugald C. Jackson, of the Massachusetts Institute of Technology, in reference to the organization of the engineers in the electrical industry for special service to the Government. In these suggestions I heartily concur with Dr. Jackson.

"Electricity and electric power will play a very important part in the preparations for and conduct of the war in which we are about to enter. It is safe to say that the most highly trained and best disciplined electrical engineers in the country are those in the employ of the electric central stations and electric manufacturers in the cities throughout the states. In many of these cities, as in my own city of Baltimore, the central-station companies are furnishing large amounts of power for the operation of industries, including munition plants, upon which the Government will be largely dependent for supplies, and to steam railroad companies for an important part of their transportation requirements.

"It is necessary that these power sources be conserved and operated for the benefit of the Government, and that locally the Government should have recourse to the services of the trained engineers in the employ of the power companies. The large electric central stations and the electrical manufacturers throughout the country are already organized, in a sense, for the interchange and dissemination of engineering information and for general educational purposes, through the National Electric Light Association, which has an enrollment of some 15,000 members in the electrical industry.

"This association is organized for effective work, through a large number of committees, including in the neighborhood of 1,000 active men. Should the Government find it advisable to take steps toward the organization of the men in these industries, to bring about their most efficient use for preparedness and defense, as president of the National Electric Light Association, and individually as an engineer of experience, I should be most glad to offer my services to the War Department in any way that you may see fit to utilize them.

"Many of the electric central-station companies have already made special provision for such of their employees as may volunteer or be called for military service. It is highly probable, however, that a large number of the employees of these companies can be used to better advantage, in view of their special training, for local work in connection with the supply of power, and in engineering and organizing work in promoting efficiency in the production of supplies and munitions, and in perfecting local defense.

"It is to suggest your consideration of this phase of the situation both as Secretary of War and as chairman of the Council of National Defense, before numbers of specially trained men enlist for ordinary service, that I am encroaching upon your time in these more than busy hours."

FUEL OIL SEEN AS A SUBSTITUTE FOR COAL.

Electrical and Mechanical Engineers Discuss Power-Plant Problems at Joint Meeting in Boston.

A joint meeting in the form of a "power-plant symposium" was held by the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, at Boston, April 4 and 5. Sessions were divided between the Engineers' Club and Wentworth Institute. The meeting was largely attended. Principal A. L. Williston, of Wentworth, was the presiding officer.

A feature of the session of Wednesday was a paper by Frederic Ewing, mechanical engineer, of the Mexican Petroleum Corporation, New York. He spoke on the relation of fuel oil to the present coal situation, describing the ready adaptation of oil-burning apparatus to furnaces and the economies and convenience of fuel oil as a substitute for the present high-priced coal.

R. Sanford Riley, president of the Sanford Riley Stoker Company, Worcester, Mass., gave an illustrated address showing various installations.

I. E. Moultrop, assistant superintendent of construction, Boston Edison Company, described recent progress in high-pressure and high-temperature turbines in power plants. He said that until a new metal or composition is available it is unlikely that steam pressures can go much above 300 pounds per square inch, or temperatures above 700 degrees Fahrenheit.

Prof. Lionel S. Marks, of Harvard University, mechanical engineering department, described recent experiments in combustion by the United States Bureau of Mines. These showed that a thickness of fuel exceeding four to five inches is unnecessary from the standpoint of economical combustion and that improvements in combustion depend largely on the better control of excess air supply.

Mr. Boeck, a New York boiler engineer, was the last speaker; describing recent advances in boiler construction.

Thursday's session was opened by Professor Williston, who turned the meeting over to Dr. F. R. Hutton, representing the A. I. M. E. Walter N. Polakov, consulting engineer, New York, spoke on "Principal Factors in the Selection of the Source of Power." He held that it is not safe to generalize that central-station power is cheaper than that secured from a good isolated plant. He pointed out that a thorough study of all factors, present, past and prospective, by an unbiased engineer, is the prerequisite to a proper decision whether to make or buy power. Mr. Polakov held that the N. E. L. A. is overstepping proper bounds in its eagerness to replace every isolated plant with central-station service, and he objected to its

well known hostility to the municipal idea, which he believed held possibilities of great advantage to the public. He went further, and advocated a greater nationalization of resources and power sources, this being in line with efficiency and economy.

A. R. Meek, eastern agent of the Ridgeway Dynamo & Engine Company, presented a detailed argument in favor of the isolated plant, but conceded that there are conditions under which central-station service is the logical thing.

J. J. Kirkpatrick, manager of the Holyoke (Mass.) municipal electric and gas plants, pointed out the benefits that have accrued to that city by the operation of these utilities. The lighting rate is the lowest in the state, the city gets its street lighting for a fraction of what it would cost if furnished by a private company, and the plant investment is low, by comparison with plants of the same capacity, privately owned.

A banquet, with informal speeches, concluded the convention.

PRELIMINARY PLANS FOR OHIO ELECTRIC LIGHT ASSOCIATION.

Twenty-Third Annual Convention to Be Held at Cedar Point, O., July 16 to 20.

General arrangements have already been determined for the twenty-third annual convention of the Ohio Electric Light Association, which in accordance with the annual custom since 1910, will be held at the Breakers Hotel, Cedar Point, O., on July 16 to 20, inclusive. The hotel is being still further enlarged by adding two wings of 200 rooms, so that every facility will be available for the largest attendance.

The business and technical program is still a tentative form. As at present outlined it provides for eight sessions, as follows: Monday afternoon, president's address and association business matters; Tuesday morning, report of Meter Committee and discussion of meter subjects; Tuesday afternoon, address by W. S. Barstow and one of the electrical engineers of the Bureau of Standards; Wednesday morning, report of Committee on New Business Co-operations and discussion of new-business subjects; Wednesday afternoon, addresses by experts on industrial heating and general discussion of subject; Thursday morning, report of Station Operating Committee and discussion of operating problems; Thursday afternoon, report of Transmission and Distribution Committee and discussion of these topics; Friday morning, election of officers, reports of miscellaneous committees, and other routine Association matters.

The secretary of the association is D. L. Gaskill, Greenville, O.

HYDROELECTRIC POSSIBILITIES OF SOUTHERN RIVERS SHOWN BY SURVEY.

Federal Board Learns Not Over Million Horsepower Can Be Obtained by Development of Principal Streams.

The interdepartmental board created by the President to consider the question of the government nitrate plant will shortly send representatives through the West to investigate sites proposed for this purpose. The board recently visited sites offered in the South and when the western investigations are made, will present a report on the best site or sites. At the same time it is expected that the committee of the American Academy of Sciences to consider the problem of the process to be used will be ready to report.

The board consists of the Secretaries of War, Interior and Agriculture and was accompanied on its Southern trip by General W. M. Black, chief of army engineers; Colonel C. Keller and Captain C. L. Sturdevant, of the engineers corps; Colonel C. B. Wheeler of the ordinance department; Dr. C. O. Smith, director of the geological survey; O. C. Merrill, engineer of the forestry service; Dr. C. L. Parson, bureau of mines; J. N. Carothers, bureau of soils.

At Columbia, S. C., the first city visited, the Broad and Saluda Rivers, it was urged, could develop more than 50,000 horsepower; at Augusta, Ga., it was stated that two developments on the Savannah River, 20 miles apart, would furnish 92,000 horsepower. At Atlanta, Ga., both the Coosa and the Chattahoochee were advocated, the former, it being stated, being capable of developing 100,000 horsepower, while on the latter, the Georgia Railway & Power Company's development was pointed out as an example of what could be done. Muscle Shoals, of the Tennessee River, at Birmingham, Ala., was discussed, the development of this site, according to information offered, furnishing 680,000 horsepower for obtaining nitrogen from air. Citizens of Tuscaloosa, Ala., presented a plan for combining the power from the locks on the Warrior River with a steam plant, to be erected there because of the cheapness of coal. At Nashville, Tenn., residents of towns on the upper Cumberland River stated that 75,000 kilowatts could be developed by eleven dams. It was learned that Nashville, however, favored Muscle Shoals. A project was suggested at Louisville for utilizing the 50,000 horsepower that could be obtained from the falls of the Ohio River for ten months a year and combining this with a steam plant. A steam plant was also suggested at Wheeling, W. Va.

JOVIANS WANT LINCOLN HIGHWAY ILLUMINATED.

Ohio League Inaugurates Movement to Light Section as Initial Step in Illumination of Entire Road.

A movement has been started by the Stark County (O.) Jovian League, comprising members of the Order from Massillon, Alliance and Canton, to illuminate that part of the Lincoln highway which goes through that county, measuring 33 miles. The National Jovian Order will be asked to support a movement to illuminate the entire length of the highway.

The Lincoln highway is the longest road in the world. It connects twelve states and is laid out between New York and San Francisco as directly as possible consistent with the topography of the country. Its length is about 3,284 miles. The development of the Lincoln highway and the national interest which has been aroused in it have been responsible for a tremendous increase in the volume of trans-continental touring, and it stands as a foremost example of the most economic need of the United States, connecting highways and leading from a definite point to some other definite point.

To light the highway throughout its length would be a great achievement and an improvement that would be of great benefit. This is an important proposition, and one that the Jovian League should push through to completion. Such was the statement of O. F. Acuff, new-business manager of the Massillon Electric & Gas Company, operated by the Henry L. Doherty & Company, and president of the Stark County organization at the first rejuvenation of that league held at Canton recently. It is believed that if the 33 miles of the highway running through Stark County is illuminated it will give the necessary impetus to illuminate the entire length.

This proposition has received the support of Mayor Stolberg of Canton, O., and has been endorsed by prominent business men of that city, as well as newspapers, who have pledged their support to this project.

The cost of illuminating the 33 miles, according to Mr. Acuff, would be about $4,000 a year, and it is planned to either have the Jovian League subscribe this amount or interest the various cities along the highway to contribute.

STEAM TURBINES FOUND ECONOMICAL FOR SMALL PLANTS.

Dallas Station Installs Turbines and Reduction Gears for Moderate-Speed Generators.

The efficiency of the steam turbine for small generating stations is well illustrated by the new power plant recently installed in Dallas, Tex., by the Union Terminal Company in connection with the new union passenger station erected there.

The power house from which light, heat, and air is furnished for the station building, and power for the interlocking system, is located south of the main station building. It is of concrete construction and comprises generating room, boiler room, and basement.

The generating room represents a notable departure from past practice in that steam turbines have supplanted the customary engine-driven generating sets. These turbines, which are of the high-speed type, are connected to moderate-speed generators by reduction gears. The apparatus installed consists of one 250-kilowatt and two 187-kilowatt three-phase, 60-cycle, 2,400-volt Westinghouse units. In the design of the turbines special features are incorporated for obtaining high efficiencies for all ranges of load. A seven-panel switchboard is also installed, consisting of three generator panels, one exciter panel, one regulating panel, and two distributing panels.

Air for the interlocking system is furnished by a cross-compound two-stage air compressor, having a normal capacity of 1,000 cubic feet of free air per minute. A motor-driven compressor is utilized for operating the relay on the interlocking system.

A water heater, utilizing the exhaust steam from the various units in the power house is used for heating the station building, the water being circulated by two motor-driven Volute pumps located in the power house.

Three 12-ton refrigerating machines are located in the station building. Two of these are in the basement and are used for cooling the drinking water only. The other one is on the third floor and is used for cooling the various boxes in the kitchen, storeroom and drug store.

The accompanying illustration shows a general view of the turbine room. Reduction gearing is inclosed. The exciter for each generator is mounted on the same shaft.

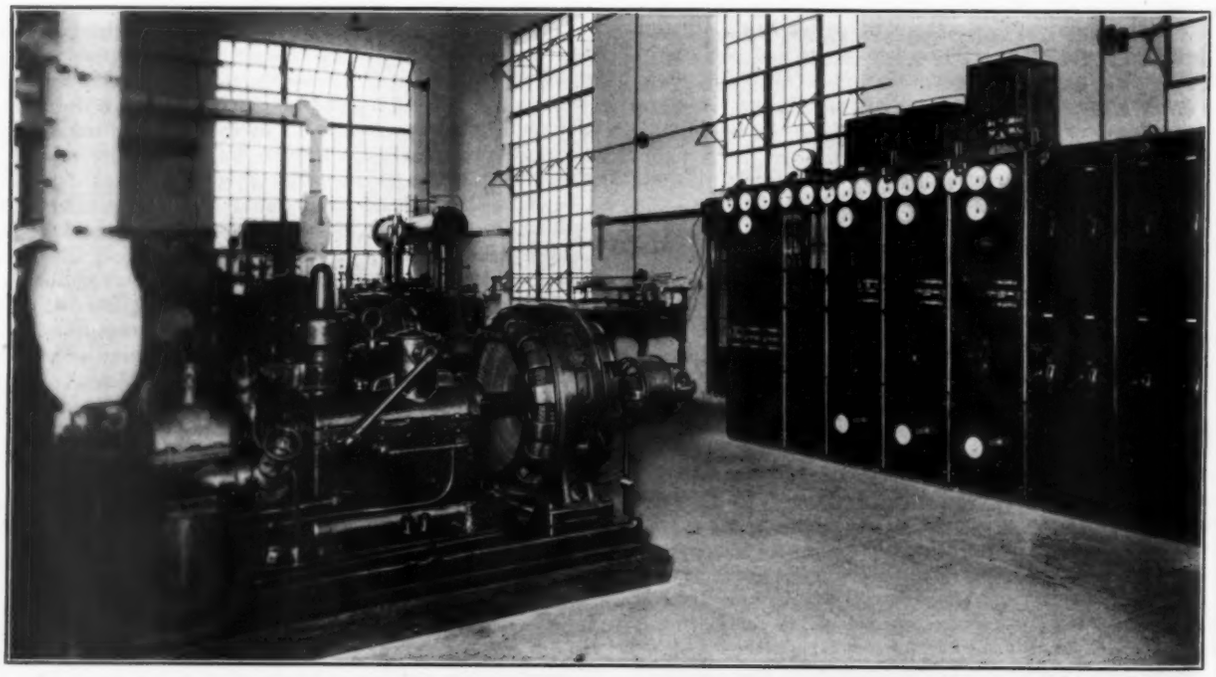
POSITION OF N. E. L. A. SHOWN BY MEMBERSHIP CANVASS.

Companies Not Now Members Represent Only 10 Per Cent of Capital Invested in Central-Station Industry.

"That the National Electric Light Association has not only become an indispensable factor in the sound development and rapid growth of the central-station industry as a whole, but has found a definite sphere of usefulness also in the every-day activities of those engaged in the business, must be apparent to anyone who has recently had the opportunity of talking with central-station executives in various parts of the country from one coast to the other." In these words, Walter Neumuller, of the New York Edison Company, who has recently completed an extensive trip in the interests of N. E. L. A. membership, described to a representative of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN the position now occupied by the association in the central-station industry.

One of the best indications of the usefulness of the association is the fact that on the desks or within easy reach, of practically every executive visited were to be found one or more copies of the association's proceedings or handbooks, many showing distinct signs of frequent reference. "That there should be some central-station companies who are not yet members of the association must, therefore, seem incredible. Fortunately, however, it can be stated that these represent less than 10 per cent of the capital invested in the industry and consist chiefly of companies operating in the smaller communities," said Mr. Neumuller. "In its recent efforts to reach these companies already invited into membership by letter, the membership committee undertook to organize a personal canvass with the help of the membership at large. In this work more than 200 executives of member companies have freely given of their time during the last two weeks and the reports thus far received predict a most satisfactory result.

"In times like these it is especially important that the association represent practically 100 per cent of the industry and this seems about to be realized, is the conclusion of Mr. Neumuller, who will be largely responsible if this record is achieved."



View in Dallas Power Plant Showing Steam Turbines Driving Moderate-Speed Alternating-Current Generators by Means of Reduction Gears

Miscellaneous NEWS NOTES

Right of Way for Telephone Companies in Pennsylvania.—A bill has been introduced in the Pennsylvania Legislature giving telephone companies the right of eminent domain over private and public property. The bill also gives competing telephone companies the right to consolidate.

Capitol Flag to Be Illuminated.—Senator James A. Emerson, of Warrensburg, N. Y., has amended the act relating to the public buildings of New York State to cause the flag of the United States to be displayed at all times on the Capitol Building and to be electrically illuminated between sundown and sunrise. Senator Emerson's amendment had already passed both the Senate and the Assembly and is assured of the Governor's signature.

War May Affect Oil-Burning Plants.—The war with Germany may prove a serious interference to lighting plants using oil engines as prime movers. The city of Jacksonville, Fla., operates its lighting plant in this manner and notice has been received by the mayor from the Gulf Refining Company that it may have to suspend its contract for furnishing fuel oil. The Government, the notice states, will take over its tank steamers if they are needed. This will prevent delivery of oil from Cuba. The lighting plant at Jacksonville keeps only a 15-days' supply and if these boats are commandeered, a new source of supply must be found at greatly increased expense.

Louisville Employers Form Organization.—James Clark, Jr., president of the James Clark, Jr., Electric Company, and a number of other Louisville manufacturers and employers have incorporated the Employers' Association of Louisville, which will include employers in all lines in its membership. The purposes of the organization are to arrange for investigation and adjustment of any questions arising between the employer members and their employees and to assist each other in the conduct of their individual businesses in such lawful manner as may be approved. In addition the association will maintain a free employment bureau. There is no capital stock and the expenses of the organization will be kept up by dues and assessments.

Public Utilities Reports, Annotated.—State commissions are constantly making rulings affecting electrical equipment and methods of installation. These rulings are of importance to manufacturers of electrical apparatus and are now being made available in "Public Utilities Reports, Annotated," issued by the Utilities Publication Committee, 50 Church Street, New York City. The executive committee of the National Electric Light Association has formally endorsed this service. Members are being urged to interest themselves to secure its benefits and help to support it. Over 1,800 subscribers are now on the list and 2,150 will make the service self-sustaining. Through the courtesy of the committee, the association is able to offer non-subscribing members and their companies an opportunity to secure the complete service to date at a special rate.

Trade Conditions Discussed in St. Louis.—At the luncheon of the St. Louis Jovian League, on March 27, D. H. Kramer, head of the export department of the Century Electric Company of St. Louis, delivered an address on trade conditions in foreign countries. Mr. Kramer has just returned from an extended tour of the world and the first-hand information which he gathered made his talk of more than usual interest. He pointed out the fact that American manufacturers had better build a reputation for reliable products at consistent prices than attempt to compete with the low prices and inferior qualities of British and German manufacturers—some of the apparatus exported by these countries being of a rather unreliable and unsatisfactory grade. R. J. Russell, secretary of the Century Electric Company, presided as chairman of the meeting.

Plans Approved for Seattle Hydroelectric Plant.—Plans for a generating station of the proposed $3,000,000 hydroelectric plant for the city of Seattle, Wash., have been approved by the Board of Public Works, and it is expected that bids for the construction work will be called for in the very near future. The capacity of the plant will be about 25,000 kilowatts.

Kansas Branches, A. I. E. E., Hold Joint Meeting.—A joint session of the Kansas State University and the Kansas City branches of the American Institute of Electrical Engineers was held March 28 at Lawrence, the ninth annual electrical engineers' day of the university. C. H. Taylor, of the Westinghouse Electric & Manufacturing Company, delivered the principal address, relating events leading up to the development by his company of the standard line of geared turbogenerator units, and outlining the latest practices. Prof. H. P. Cady, of the university faculty; J. T. Skinner, of Lawrence, and F. B. Uhrig, of the Western Electric Company, Kansas City, also spoke during the day.

New Jersey Utility Company Announces Organization Changes.—The Public Service Corporation of New Jersey, Newark, has announced the following changes and appointments: Edmund W. Wakelee and Percy S. Young, vice-presidents and directors; Dudley Farrand and John L. O'Toole, assistants to the president, former vice-president and general manager, and publicity agent, respectively; T. Wilson Van Middlesworth, treasurer, succeeding Percy S. Young; William S. Barker, formerly assistant treasurer, comptroller; F. A. Neis, assistant treasurer; Farley Osgood, vice-president and general manager, succeeding Mr. Farrand; Harry C. Stevenson, assistant to the vice-president, in charge of public relations; William H. Feller, assistant secretary, succeeding Mr. Stevenson.

Hydroelectric Development in the South Marked.—Thirteen large sized hydroelectric plants have been planned or begun in the southern states since the first of February. The $5,000,000 plant to be built at Wateree, S. C., by the Southern Power Company, is the largest project. The increasing utilization of water power for electric plants in the East, particularly in the Southeast, is a significant fact of interest not only to the electrical industry, but to all persons interested in conservation and industrial development. The public utility concern which furnishes cheap power through a hydroelectric plant naturally aids in developing the neighborhood industrially and this in turn creates a wider field for public utility service. If the use of electricity is any mark of progress, the southeastern part of this country is progressing rapidly.

Pennsylvania Telephone Companies Ordered to Reduce Rates.—Following an investigation dating from November 21, 1913, of the rates of the Bell Telephone Company of Pennsylvania and the Central District Telephone Company, the Public Service Commission of Pennsylvania has handed down an order (April 5) directing the companies to make reduction in rates to effect a gross amount of $1,000,000 annually. In its decision the Commission says: "We are of the opinion that a reduction of the revenue should be brought about by a readjustment of the schedule of rates in Pittsburgh and Philadelphia and the toll rates, which will amount in the aggregate to $1,000,000 annually. The amount of reduction in Pittsburgh will be approximately $300,000; in Philadelphia, approximately $450,000; and of the toll rates, approximately $250,000. This reduction is based on the present business of the company. The telephone companies have allowed a continuation of existing flat-rate contracts, but refuse to allow new subscribers the same privilege. This constitutes a discrimination as between the subscribers, and we are therefore of the opinion that the existing flat-rate contracts be eliminated and all subscribers treated alike."

Central-Station Power in a Veneer Plant

Details of the Motor Equipment in a Typical Plant and a Discussion of the Advantages Which Have Accrued from Central-Station Operation

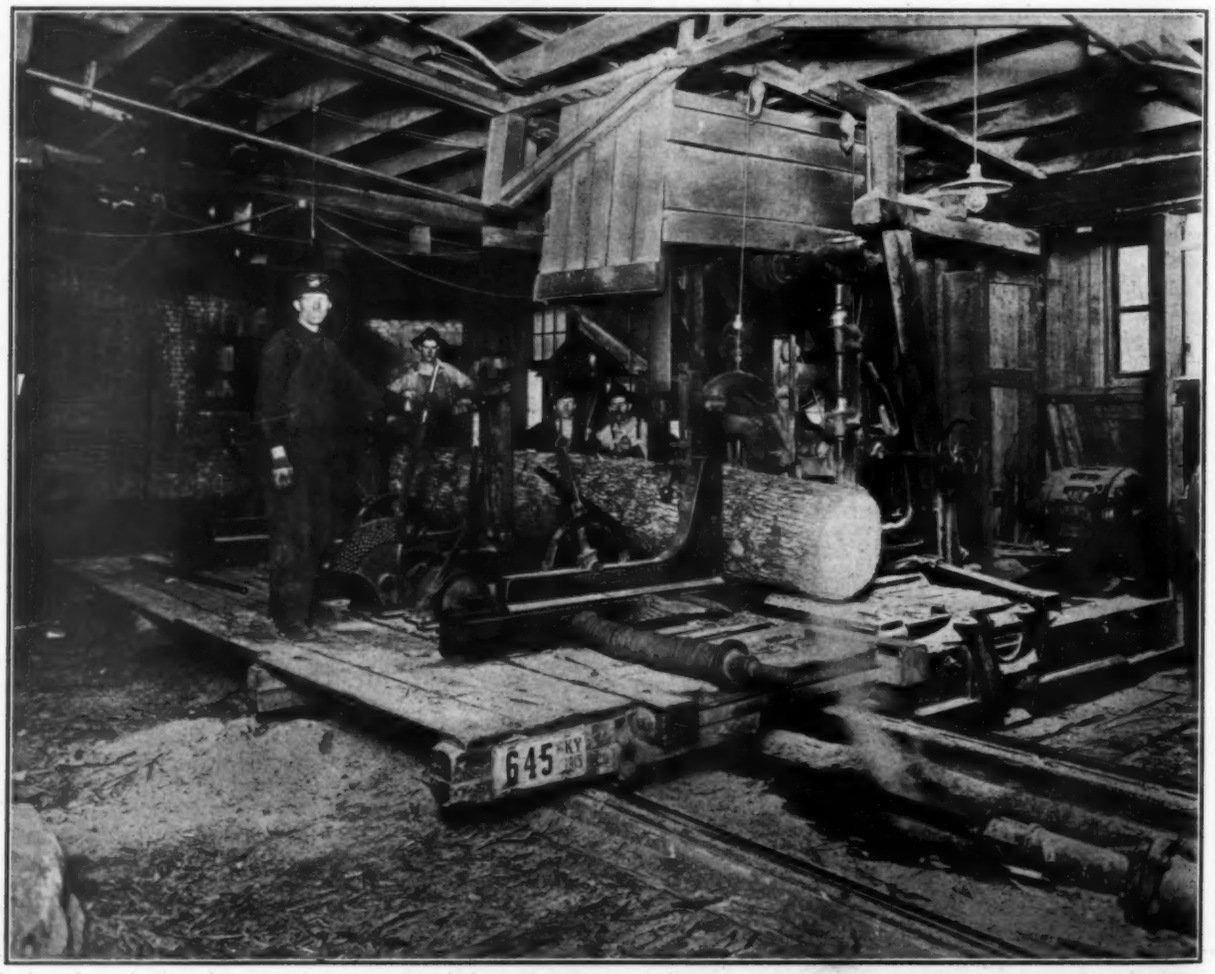
Industrial Power Series—Article No. 196

IN THE course of the steady progress being made by engineers of sales of the Louisville (Ky.) Gas & Electric Company toward conversion of the woodworking plants of the distribution system of the company into plants operating by electricity, the Southern Veneer Mills was reached. This is a typical combined sawmill and veneer mill, working up hardwood logs into veneers. It is a plant of moderate size, housed in two buildings. A. S. Witmer, engineer of sales for the central-station company, listed the prospect about two years before the contract was signed up. His original efforts toward concluding the contract were assisted materially by the good results which were being obtained by other Louisville woodworking plants which were utilizing electric drive. At length, when the proprietors of the plant took up the proposition seriously the contract was readily closed.

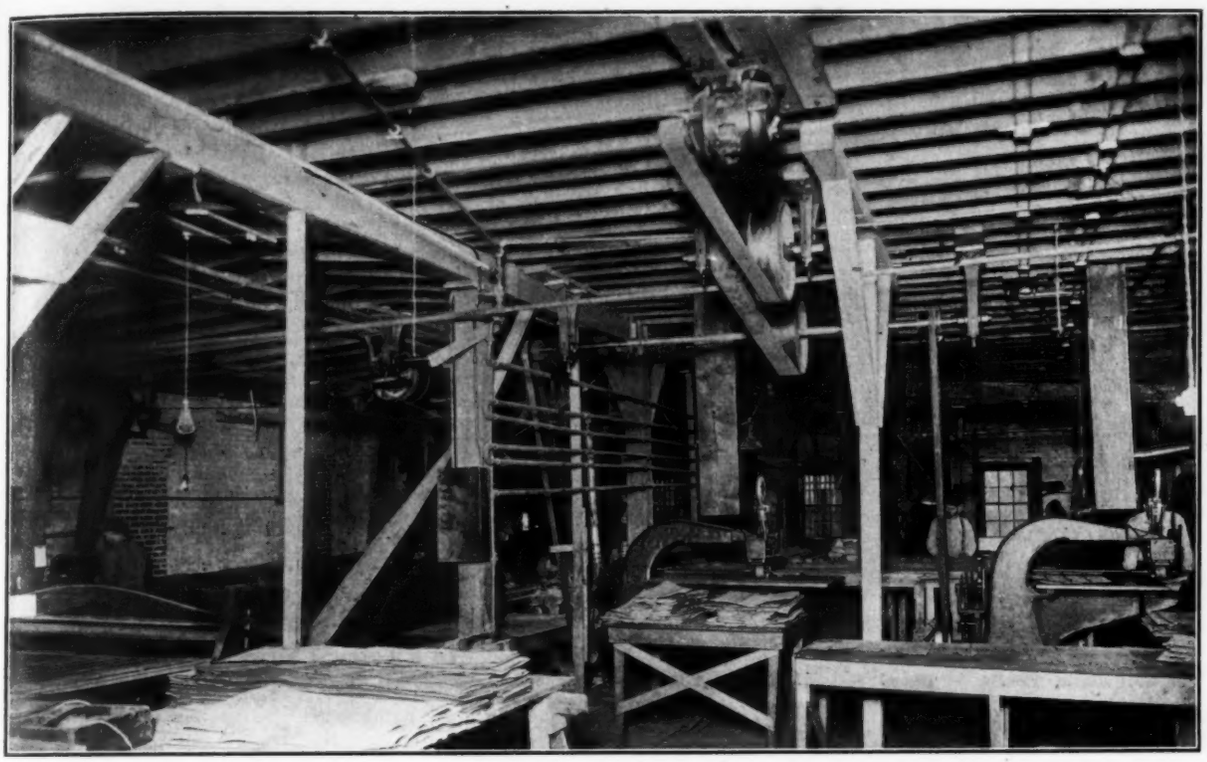
Conversion of the plant involved replacing of the steam engine and transmission system with a total of 15 motors, the connected load totaling nearly 225 horsepower. The engine in use was rated at 150 horsepower, but was often driven with a load up to 200 horsepower, a large part of the power, of course, being absorbed by the system of line and countershafting, belts, etc. Allis-Chalmers motors were installed throughout, and they have been in use since the first part of October of 1916. They range in capacity from three horsepower to 75 horsepower, and operate three veneer saws, a rotary slicer, a seven-inch band saw, a slicing machine, dryer, edger, three clipper and taping machines, saw grinder, cut-off saws, a ripsaw, a cross-cut saw, jointer, and a blower calling for 15 horsepower.

Certain sections of the existing shafting and belting were utilized in cases where several machines were grouped to be driven by the same motor, though for the most part this old equipment was discarded and sold, as was the engine. The old boilers were continued in service and maintain a good head of steam, for operation of the dryer and for operation of the "shot-gun" carrier used in the band sawmill. When the band mill is in operation the waste from it and from the veneer saws, conveyed directly to the fire box by the blower, suffice amply to keep up the steam. At other times coal is used to supplement this waste fuel.

Outside of the manner of the installation of the motors, etc., there are several engineering features which are worthy of note in connection with this plant. Some of them



Motor-Driven Band Saw Mills in Plant of Southern Veneer Mill, Louisville, Ky.



Group of Motor-Driven Woodworking Machines In Southern Veneer Mill.

were applicable as sales arguments before the contract was closed; some have developed with more force through observation of the operation of the mill. Incidentally, since this was not the first mill of its kind changed over through the efforts of the Louisville Gas & Electric Company's representatives, presentation of the arguments was a simple matter. After one or two band mills and veneer mills have been converted it is no longer necessary to make a lot of load tests on the various machines. Reference to records of previous jobs provides the necessary data, and the engineer of sales can talk with plenty of confidence, because he knows what he is talking about.

Arguments for Electric Drive.

Another thing that is good for the engineer selling service to put down in his book—and that is he can promise the prospect that his estimates of consumption of current will not be realized by about one-third. For instance, in the case of the Southern Veneer Mills the estimates pointed to a monthly consumption of power at the rate of 18,000 kilowatt-hours. Mr. Witmer was able to assure the owners of the mills that this total would not be realized. Of course, if the equipment were being used to capacity all the time this would not be true. Not only is the demand on a motor much less than its capacity while in operation, but there are more frequent stops than the operator of the mill would expect. With steam, on the other hand, the power has to be kept up. But current consumption by the Southern Veneer Mills for the first three months on electric drive was 12,747, 10,610 and 11,300 kilowatt-hours, respectively, while the output of the mills was maintained.

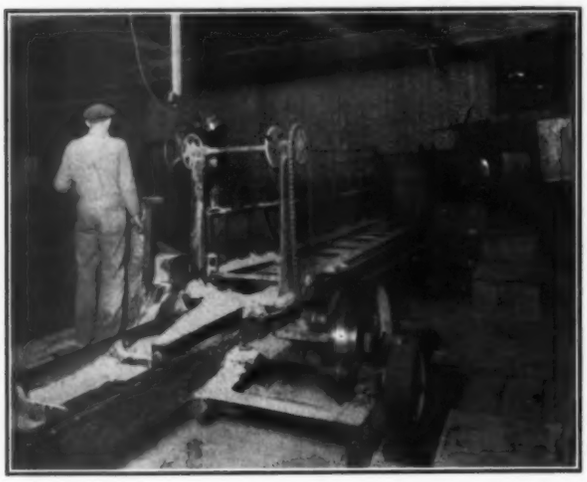
The usual arguments in favor of the electric drive applying to woodworking plants operated on steam could be applied here. The instant availability of power; practical immunity from breakdowns and assurance that in such case only a limited section of the operation would be affected; elimination of at least one high-cost engineer, to be replaced by a laborer, to watch the steam gauge and supplement the waste fuel by a few shovels of coal when necessary; flexibility of the new power; acquisition of considerable additional floor space with dismantling of the engine room—all these and the other points to be urged in favor of electricity were made use of by the power company.

This mill, as is the case with all mills operating on logs, makes a large quantity of slab and block waste. Before the motors were put in this waste was wheeled to the boiler room and fed into the furnace. Now, however, there has been a small cross-cut saw installed, which converts these slabs into blocks for kindling or into lengths suitable for burning in fireplaces. The fireplace is already an important and an honored adjunct in the modern home, and during the past winter coal has been unprecedentedly costly, so breaking into the fuel wood market has been easy, and now the company has built up a business which there is every reason to consider will last as long as there is wood to burn. Again, this method not only yields a pleasing revenue, but it obviates necessity of handling the waste to the boiler room, for all the waste that is conveyed there now goes by way of the blower pipes, emptying directly into the fire box.

An interesting feature of the installation in the band mill department is that a slip-ring type of motor is used, with a capacity of 50 horsepower, which drives the band saw at 8,500 feet per minute. On this motor the starting load is very heavy, but the slip-ring motor meets all the requirements readily, where it is reasonable to consider that ordinarily a motor of larger capacity would be called for.

Elimination of the large friction load represented by the system of line and countershafting and belting is appreciated by the owners of the plant, but a feature which has not been emphasized generally has been much commented on by the proprietors. This is the relief from the racket which was made by the transmission equipment before the modern installation was made. The effect has been marked in all departments, and the result has been favorable in numerous ways. The men employed in the plant work better and with less distraction. Danger always threatened under the old dispensation is very largely done away with now, and elimination of the noise has improved the morale of the force and distinctly increased the efficiency, according to the observations of the owners.

Reference has been made to the fact that observations of a plant after it has been equipped for electric drive will often yield good ammunition for the engineer of sales. An instance in point is supplied by the Louisville Veneer Mills,



Veneer Saw Room.

also a Louisville woodworking plant, which changed over to electric drive in 1912. The installation was described and illustrated in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in the issue of February 22, 1913. This is one of the largest plants of its kind in the Louisville vicinity, and was one of the first to use central-station service. Not only has electric drive given utmost satisfaction to the owners, but incidental advantages have been noted during the several years under the new regime.

Economies of Central-Station Operation.

The plant lies near the Ohio River in the eastern part of the city, and, when the river breaks its bounds and floods the lowlands, as it has done in the last quarter century several times, the Louisville Veneer mills plant is in part submerged. Before the change was made a threatened flood meant a threatened shutdown, idleness for the employees, and failure to get out its orders for the plant.

Motor-Driven Shapers.

Shortly after the motors were installed in this plant a flood was experienced. Had it come early in 1912 it would have meant a complete tie-up. During the flood of 1913, however, the spectacle was presented of employees of the mills going to their work in rowboats. Where the engine and boiler had been was a raging flood. Operations on the ground floor were interrupted, of course, but all the plant on the second and third floors continued without loss of an hour, and remained in operation until the flood subsided, the first floor being untenable for about a month.

Another important advantage not ordinarily noted was observed during parts of 1914 at this plant. As everybody in the lumber and woodworking trade recalls vividly, that was an off-year. Everybody's orders slumped, sometimes disastrously. With a central steam plant in which power sufficient to operate the entire plant must be kept up to run any part of it, a total shut-down would have been imperative. Here, however, the division of the plant into departments, operated in groups or individually, made it possible to adapt operations to business in sight. So instead of having been laid off altogether for the most of the year, the majority of the men were able to get in part time during the depression—doing better here than they could hope to do elsewhere. By this advantage the company not only kept in operation in part, but it was also able to hold its organization intact, and, when business picked up, could and did jump into the field with a lead on less fortunately situated companies.

New York Police Department Now Has Squad of Electric Patrol Wagons.

Unlike the Paris police, the New York police, in war time, will not be without vehicles for city service no matter whether all of the gasoline trucks and patrol wagons of the department are confiscated by the government. With an eye to such a possibility the New York department has recently purchased four electric patrol wagons which with the one that has been in service for some time will constitute the basis of the city's patrol service in such an emergency. And it is likely that others will be added within a reasonably short period, to provide against any possible shortage of vehicles when the War Department begins to make demands.

These electrics are capable of making from 100 to 120 miles a day under pressure. In their present service they average approximately 70 miles daily. The original electric police patrol, which is still in service, has seen much in the way of emergency service. It was the first vehicle at the Triangle fire and it was used to transport most of the victims from the scene of the disaster. The service rendered by this 10-year veteran presented the assurance that the department would not suffer if it was necessary to rely upon vehicles of that type entirely.

Electric Steel and Electrode Production in England.

It is expected that there will be a very big production of steel by electrical processes in England after the war. In this connection an electrode factory is being erected at Newcastle-on-Tyne by Alby United Carbide Factories Limited which will start with an annual capacity of 5,000 tons. The plant will probably be running by September of this year.

At present the company consumes about 4,000 tons of electrodes every year and prior to the war purchased from Germany and Austria. Since the war began the purchases have been made in America, but a few months ago owing to the uneasy shipping conditions the erection of the Newcastle works was decided upon. The company expects to make a saving of $75,000 per annum as the result. It is considered certain that the factory will have to be considerably enlarged in the very near future. The electric production of steel is going ahead rapidly now, but it is expected to accelerate its rate of progress after the war, consuming very large quantities of electrodes.

Commercial Uses for Filtered Light

Practical Application of Filtered-Light Units to Store Lighting, Daylight-Quality Illumination of Art Museums, Color Matching in Textile and Dyeing Establishments, and for Other Purposes

By C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania.

This is the second article dealing with the commercial possibilities of filtered light, prepared at our request by Professor Clewell. In the first article, published last week, methods of production were outlined, while in the present article some of the more important applications are treated, including references to special uses for colored glass screens in filtering out harmful components, as in the light from arc welding or from the quartz mercury-vapor lamp. It is our idea that the central-station salesman who is not fully aware of the possibilities in this field will find this article of considerable value in his practical every-day work of promoting better lighting.

IN A previous article[1] the term "filtered light" was defined according to the liberal sense in which it is used in this article, that is, to include various methods of color modification in the lamp itself or in its auxiliary, such as the fluorescent reflector used with mercury-vapor lamps, and also the use of colored glass screens by which to absorb a portion of the undesired components from a light source. In particular, it was pointed out that in practically all lighting work, the quality of illumination should receive more attention than its efficiency, although in a general way, excellence in quality is possible with modern illuminants and their accessories with a high degree of efficiency in the utilization of the light.

It is to be noted, however, that whereas the rapid reductions in the watts-per-candle ratings of lamps, first, in the vacuum Mazda type and more recently in the various gas-filled Mazda units, have made it possible to reduce more and more the energy consumption for given floor areas and for given illumination intensities, the present movement to promote the use of color screens so as to modify the color of the original light from these lamps is a tendency to increase rather than to reduce the energy required for given floor areas even where the very highly perfected gas-filled Mazda units are considered.

[1]ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Vol. 70, No. 14, pages 565-568, April 7, 1917.

Tangible and Intangible Advantages of Filtered Light and Growing Interest in Subject.

The central-station salesman has, therefore, the opportunity to distribute these modified units, thus tending to increase the revenue from lighting; the main, and perhaps the only, advantage for the consumer being an improved quality of illumination. As we shall show below, this improvement in quality may be such as to yield tangible returns, as in the greater accuracy made possible for such

Fig. 1.—Interior of a Fur Store Lighted With 600-Watt Mazda C-2 Lamps in Diffusing Globes.

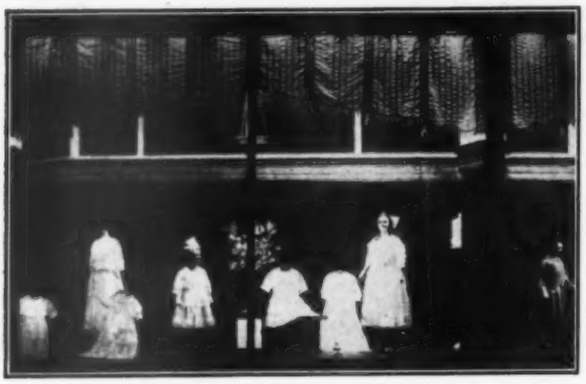


Fig. 2.—Show Window Lighted by 14 100-Watt Mazda C-2 Lamps—Central Indirect Fixture Is Not Used.

work as color matching or in the assortment of materials where careful color distinction is an important requirement. In such cases there is a very apparent return to the consumer for his investment in the more expensive equipment and for the possible increase in his monthly light bills.

In other cases, such as the lighting of art galleries and those numerous other instances where no tangible returns can be looked for other than the improved quality of vision and the greater perfection of color quality incident to the use of these lamps, it becomes important to the salesman to be in a position to outline intelligently the advantages which are afforded by these more or less intangible quantities, and to emphasize the greater importance of these advantages in comparison with the differences in cost which will follow the adoption of such a plan. As a preface to the specific applications below, the following comment by Luckiesh and Cady[2] adds an interesting viewpoint:

"Interest in the quality or color-value of light is increasing and should continue to grow, for it is of great importance in lighting problems. There is no reason to accept the quality of light from illuminants as they come to us from the manufacturers. There is much to interest the illuminating expert on this side of his problem. It is possible to obtain glassware of a proper tint to suit nearly all requirements on the scientific side from the accurate discrimination of colors to those of less exacting a nature, and on the artistic side toned glassware is obtainable in many tints. These can be supplemented by endless possibilities in silks, or glass shades and reflectors and by controlling the color of surroundings. Little attention has been given to the effect of colored surroundings in altering the color of the useful light. More attention must be paid to this factor, for it is wasteful to undergo the expense of producing a satisfactory daylight quality and waste it by permitting yellow walls and ceilings to absorb it. It is possible to produce light of daylight quality by indirectly lighting a room which has wall coverings of a proper color."

[2]Transactions, Illuminating Engineering Society, Vol. IX, No. 8, page 861.

Fig. 3.—Window Lighted by 150-Watt Mazda C-2 Lamps.

General Summary of Uses.

As hinted in the introduction to this article, there are quite a variety of uses of color in illuminating engineering for purposes other than those of color matching and distinction. H. P. Gage[3] has summarized these uses as follows: (1) direct decoration effects; (2) colored illuminations for esthetic effects; and (3) illumination for specific visual effects. These uses are amplified somewhat as follows by Dr. Gage: *Direct decoration effects* are obtained by color in the stained-glass windows of churches and in the color treatment of reflectors and shades used in ordinary lighting work. *Colored illuminations for esthetic purposes* are typified in much stage lighting and for producing the warmer tones and the artificial-daylight effects in the illumination of interiors. In these cases the light from the original lamp is filtered either through a colored lamp bulb or through a colored inclosing globe, and sometimes is reflected from the surface of a specially tinted or colored reflector. It is in this second division of the uses of color that we are chiefly concerned in this discussion. It is interesting, however, to add under the third division that for *obtaining special visual effects,* those cases are implied as in the protection of the eye from injurious radiations, as in arc welding or when experiments are being made with an arc lamp.

Artificial Daylight a Reasonable Need.

Dr. Gage points out that from his experience the complete spectrum is the most desirable for visual comfort, and concludes that this appears reasonable because the human eyes have been so long accustomed to work under the conditions of natural daylight and that they should be able, for this reason, to work steadily with less fatigue under daylight or by artificial light of the same spectral characteristics as daylight, than with other forms of artificial light. Furthermore, it is apparent from what has been stated previously that for rendering the colors of paintings or other objects under artificial light identical with their appearance by natural light, the artificial light must possess the same distribution of energy throughout the spectrum as the natural light and must appear the same color.

As pointed out earlier, lamps are now available for accomplishing this end, typified by the glass-filtered tungsten lamps, the colored checkered-glass screens proposed for use with arc lamps, the Moore tube lamp, and so on. Dr. Gage points out that the color filter for use with tungsten lamps must transmit completely all of the violet and must produce a spectrum which is smooth and with no sudden irregularities and must further produce a spectral distribution similar to that of natural light and a color which appears white. Fig. 4 shows the curve of energy distribution in a tungsten lamp filtered through "Daylite Glass" (Gage) as compared with the similar curve for daylight and for the tungsten lamp without a filter. According to Gage, glass filters of this type are constructed which transmit about 15 per cent of the light from a gas-filled Mazda lamp operating at 2,850 degrees absolute. This is, of course, a very low degree of transmission, which is less than some of the values quoted from the National Lamp Works in the previous article, these latter values probably being for less dense glass screens than are implied by this 15-per-cent figure.

Practical Applications of Color Correction.

Turning now to some of the more practical applications of color correction, we find that there is a growing tendency to employ units possessing more or less of a daylight spectrum under widespread conditions. High-class retail stores

[3]Transactions, Illuminating Engineering Society, Vol. XI, No. 9, page 1059.

dealing with an exclusive patronage, such as the fur store shown in Fig. 1, find it desirable to use daylight lamps entirely. Numerous shop display windows are now illuminated by artificial-daylight units with results that give an almost startling impression of daylight effects by night. Figs. 2 and 3 are good examples.[4] In some cases these are lighted by colored-bulb Mazda units equipped with ordinary show-window reflectors, the filtration of the light taking place in the passage of the light through the special glass of which the bulb itself is made. This plan is particularly applicable in display windows where artificial daylight is desirable for an exhibit of colored dress goods in their natural colors.

Furthermore, one of the most effective uses of these units is in dress-goods departments of large stores, sometimes in a small section only, where accurate color matching and color judgment become important to the customer. As pointed out by Messrs. Luckiesh and Cady, if a light source is used for this purpose of color distinction and blues cannot be distinguished from blacks under the artificial light, then its efficiency as a lamp for such an installation, when gauged from the standpoint of the lack of accomplishment of the desired end, becomes very low indeed. This obviously means that in problems of this kind, the viewpoint must be much broader than that which merely considers the energy consumption for the given floor area.

Rug sections in department stores have been treated similarly. One particular case in point was a rug section extending from the center of the store at the elevator stations, across to the outer wall of the store where the windows served the space during daylight hours. Near the elevators, however, artificial light was required at all hours. The row of indirect units near the elevators was equipped with daylight lamp bulbs, and the effect from the artificial units as one left the elevators on this floor gave the impression that windows were located above the elevator entrances. With the indirect units concealing the daylight lamps, there could easily be an unconscious conclusion on the part of an average customer that rug selection was being made under daylight conditions.

Important Installation in an Art Museum.

One of the most notable examples of color-correcting equipment is that of the Cleveland Museum of Art, which was fully reported[5] upon by E. P. Hyde as chairman of a committee appointed by the Museum Building Committee. This appears to have been the first large museum in this country lighted by artificial-daylight units, although Mr. Luckiesh has reported a number of smaller galleries and exhibits which have been successfully lighted by the same type of lamp prior to this large Cleveland installation.

The report of Dr. Hyde is unusually complete and gives an excellent idea of the possibilities which are open to those in charge of the construction of such public buildings, provided competent expert recommendations are sought sufficiently in advance. Although the reader may refer, with profit, to this report for statistics of this installation, several of the points which characterize the lighting seem sufficient in importance to warrant their inclusion at this point.

First of these important items, in the order of their occurrence in the report, is the urgent recommendation of this committee that in all similar cases where lighting forms such an important part of the finished structure, advice in regard to the lighting be sought before the design of the building has been decided upon.

It seems that the lighting committee in this case was not appointed until after the museum building had been completely designed and even constructed in its main points, so

Fig. 4.—View Above Skylight in Cleveland Museum Showing Arrangement of Mazda C-2 Lamps and Reflectors.

that the lighting system of necessity had to accomodate itself to the design of the building. This tendency to include lighting as an "after-thought" in so many large and important buildings is the cause of many difficulties and this case proved no exception to this unfortunate tendency. Not only is this likely to impair the effectiveness of window space and arrangement for natural lighting, but even the artificial lighting can usually be planned to better advantage if the construction details of the building can be adapted, at least in a measure, to these ends.

Of the four requirements which the lighting committee outlined, one called for artificial lighting to approximate as nearly as possible the quality of daylight. A very interesting feature of the installation, therefore, was the emphasis which was placed on the new ideas concerning the importance of the quality of illumination as an influence on paintings and other colored objects; and the further fact that artificial-daylight sources were available for carrying out these ideas. In fact, practically the entire museum was actually lighted with the Mazda C-2 or colored-bulb lamps, which produce a lighting result very similar to that of daylight.

To make clearer the few remaining notes on this installation, it may be stated that a rotunda is located in a central position with respect to the exhibition rooms. A square room, known as the Colonial Room, to the north of the rotunda, is lighted from the top to a relatively high intensity. A large room, to the east, known as the Armour Court, is lighted to a somewhat lower intensity than the north room. The Garden Court on the west is treated like an

Fig. 5.—View in One of the Galleries Showing Illumination Effect.

[4]Also see ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, April 7, 1917, page 565.

[5]Transactions, Illuminating Engineering Society, Vol. XI, No. 9, page 1014. Also ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 11, 1916, page 842, and November 18, 1916, page 885.

outdoor area and is furnished with a comparatively low intensity. Adjacent galleries contain exhibits of paintings.

The effect in these galleries is reported as similar to bright illumination from the sky. In the rotunda, the illumination is rendered warmer by the use of a number of small high-efficiency visible tungsten lamps in ornamental side brackets in addition to the artificial-daylight units located above the skylights. Figs. 5 and 6 give some idea of the means employed and the results obtained in one of the locations in this building. The notes concerning it included here are merely general, and are given to convey the idea that artificial-daylight units are now a practical working addition to the long list of electric units available at the present time. For complete information regarding the details of the installation and the engineering steps leading up to the same, the reader should see the report of the lighting committee which had the work in charge (see footnote 5).

Applications of Moore Lamp.

D. McFarlan Moore, inventor of the Moore carbon-dioxide lamp, states[6] that the commercial use of the Moore-light during the past seven or eight years indicates the carbon-dioxide unit as the only one which has given perfect satisfaction with respect to the color quality of its light. Its use has included such cases as dyeing establishments for silks, cotton, wool, fur, feather, knit goods, hosiery, thread, and the like. Mr. Moore hints further that in its latest form, see Fig. 7, this lamp will find application in the manufacture of such goods as millinery, neckties, gloves, carpets and rugs, wall paper, lithographs, color process in printing,

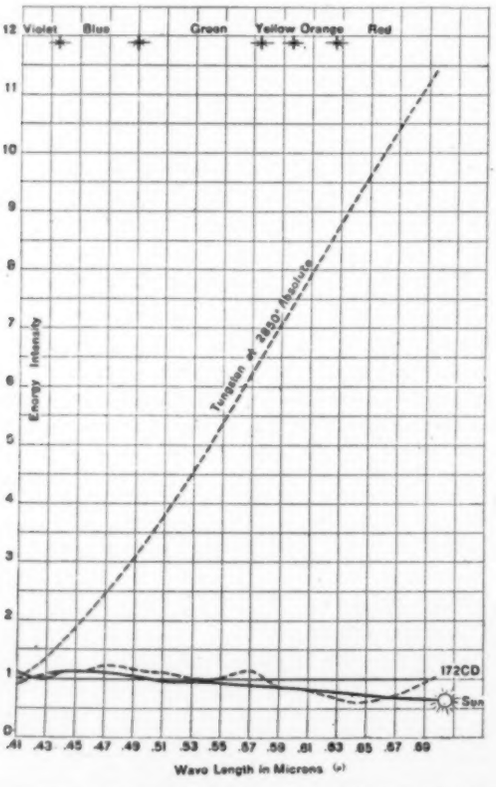


Fig. 6.—Curves of Tungsten Filament, and Light From a Tungsten Lamp Filtered Through Daylight Glass In Comparison of Energy Distribution Curve of Sunlight. Lower Dotted Curve Refers to the Filtered Light.

paints, leathers, flowers, buttons, tiles, oils, and the like; also in the merchandising of these various materials.

In this same connection, Mr. Moore says: "A good color-matching outfit is practically an economic necessity; the highly paid dyer need not stop work in the early afternoons of the winter months, losing not only his own time but interfering with the production of the mill. Often it will alone determine prompt deliveries because neither cloudy

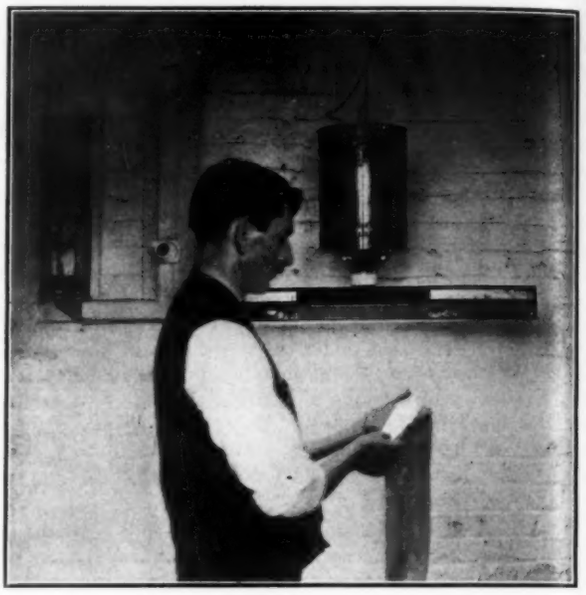


Fig. 7.—Moore Lamp In Service.

days nor dark hours of night need affect the operation of the plant. Its color matching qualities are so accurate that textile mills and a score of other industries in which the matching of certain materials is a step in the operation, can work at full efficiency at all times, avoiding mistakes and saving time and money. The accuracy of the light of the lamp is in fact such that under certain conditions it can be more thoroughly depended upon than the variable and uncertain daylight.

"Ultimately the field for a lamp giving light that will really project the most delicate shades of any hue throughout the night will be large. However, no form of color-matching lamp will permanently satisfy the dyers, for example, unless the colors in the light are absolutely perfect at all parts of the spectrum."

This same authority points out also that solid-conductor lamps, although they are efficient, because of the usual method of using screens or diffusing globes, which absorb much of the light, in reality have a poorer apparent efficiency as light producers than would appear from the rating alone. Since gaseous-conductor lamps require no such screening, because their glare is so very low in comparison to that of the gas-filled tungsten lamps, and further because they need no color modifiers, they have some advantages.

Color Preferences.

It is interesting in a study of this kind, where the major attention is naturally given to such needs as those for color matching and similar uses, to consider the element of personal preference for color of various kinds. Opinions differ as to what constitutes the most agreeable color for the human eye. C. P. Steinmetz says[7]: "I do not believe there is any particular color of light which, by itself, is less or more fatiguing than another, but the question depends entirely on the relation of the color of the light to the color of the objects which are distinguished and the purpose for which we desire to distinguish them. . . . It means in short, that the effect of color of light, in its effect on the eye, is entirely a relative condition dependent on the surrounding objects in

[6]Transactions, Illuminating Engineering Society, Vol. XI, No. 2, page 215.

[7]Transactions, Illuminating Engineering Society, Vol. X, No. 9, pages 1021, 1033, 1035, 1036 and 1037.

their color character and the purposes for which you desire to see."

W. A. Durgin (see last footnote) says in part: "My personal experience seems to indicate a majority choice of yellow light. In the offices of Commonwealth Edison Company of Chicago, where 1,200 employees work under a distinctly yellow flux, at least sixty have come forward with expressions of approval, whereas none has expressed dissatisfaction. This, however, is only an indication."

G. H. Stickney (see last footnote) says in part: "Most store managers seem to prefer the appearance of the store under incandescent illumination, and even where colored materials are sold they often consider the warm homelike effect of the yellow-tinted light more important than the degree of color-matching quality obtainable with any practical illuminants."

J. W. Schereschewsky, on the other hand, in discussing this same question, says in part: "It seems to me that, considering the matter on physiological grounds, there can be no reason whatever for asking for a yellowish tone in artificial illuminants. The nearer the approximation to the spectral composition of daylight, the better they are for seeing purposes." (See last footnote.)

M. Luckiesh states that the use of artificial daylight for several years for desk lighting has seemed to indicate that it is less fatiguing than the light from a tungsten incandescent lamp and that this is specially evident when the daylight must be reinforced by artificial light.

Other Uses.

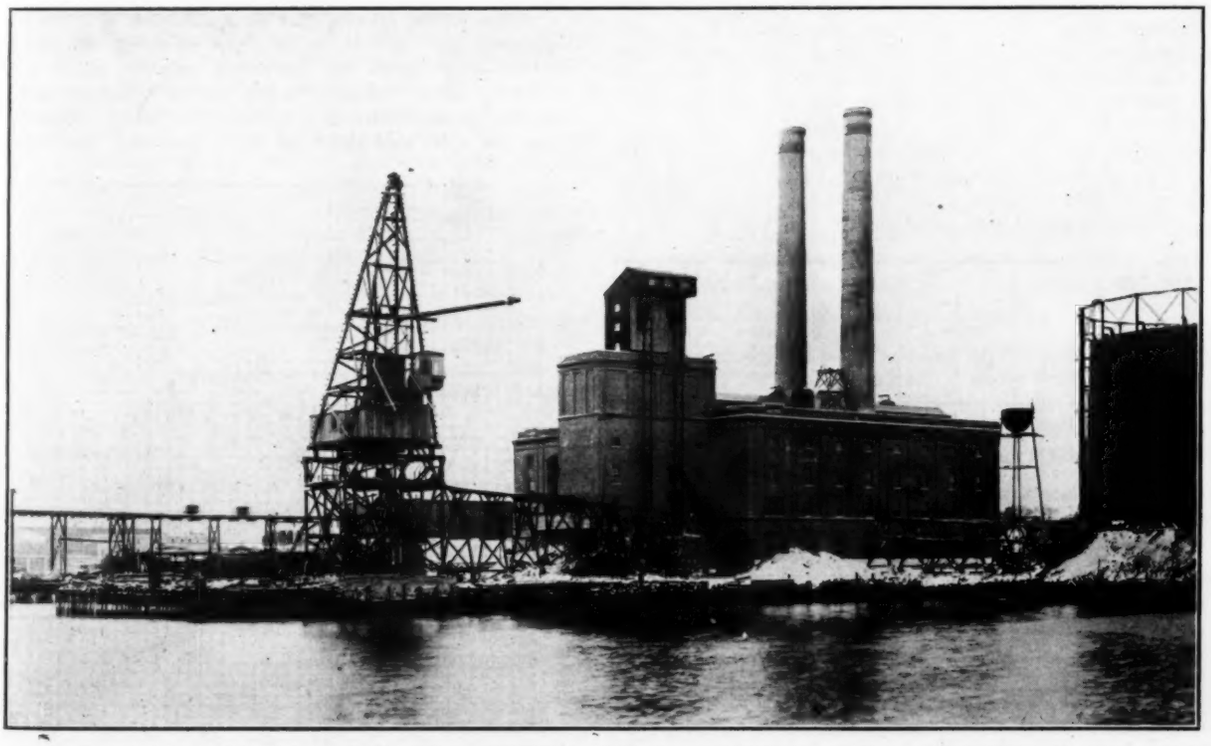
In addition to the applications of light corrected for color as previously listed, there are also a number of other uses of color screens for color modifications, for example in some branches of photography, photometry, railway signal work, etc. Various glasses have been developed, furthermore, for eliminating the harmful ultra-violet components in such operations as arc welding.

In a general way, therefore, we conclude that there is a field of considerable importance in the matter of color-correcting lighting units and while the practical lighting salesman should proceed with caution in his recommendations of one color or another for specific purposes, because of the numerous factors involved, he may well take into account the growing importance of this phase of the problem in his dealings with the lighting consumer.

In one case that has come to the writer's attention, a rather expensive system of artificial-daylight units has been installed in a store, and the testimony of the proprietor is that his sales have been sufficiently greater under the improved illumination to pay for the new system in a month or two. While such definite cases of returns would be very valuable to the salesman, much of his work of necessity must be based on more or less general terms and his art will largely be to present the principal advantages in such a manner as to be convincing to the customer, whose appreciation and judgment of these points will finally determine the sale.

In conclusion, it is desirable to throw out the hint that much of the so-called artificial-daylight equipment that one finds on the market cannot be looked upon as genuine. That is to say, the exact interpretation of what daylight consists of is more or less indefinite, and there is unfortunately a tendency to appropriate the term artificial daylight to glassware here and there which is little more than a diffusing medium for improving this quality of the illumination with little or no change in the spectral composition of the resulting illumination. It is suggested, therefore, that all those who may come into contact with conditions where a correct daylight composition of artificial illumination is desired, will do well to investigate the exact spectral character of the light rather than to accept the general statement that the lamps produce a daylight effect.

Extensions Necessary for Station at New Bedford



The New Bedford Gas & Edison Light Company has authorized Stone & Webster to construct an extension to its new power house and install a second 15,000-kilowatt turbine, making the total capacity in generating units 52,000 kilowatts. In April, 1916, work was started on the installation of one 10,000-kilowatt and three 4,000-kilowatt units in a new station. Commercial power was delivered within seven months. During the summer of 1916 the installation of a 15,000-kilowatt unit was ordered, which will be in operation this spring, and now a second 15,000-kilowatt unit is ordered.

Load, Plant and Connected-Load Factors

A Graphic Analysis of the Common Factors With Actual Problems Showing Their Application

By TERRELL CROFT

This is the third and last article of a series of three by Mr. Croft, dealing with operating factors of interest to central-station engineers and operators. In this installment Mr. Croft points out clearly the bearing of the several factors discussed upon the efficient operation of a central station. Previous articles dealt with load-factors, operating-time load-factors, connected-load factors, etc.

THE real significance of a load-factor is that it is an index to the proportion of the whole time that the machine, plant or system to which it applies is being worked at its full capacity. The machine, plant or system must be so selected or designed that it will handle the maximum power demand that will be imposed on it. But it is seldom, because of the general nature of things, that any equipment will have the maximum demand which it can handle imposed on it during all of the 8,760 hours of a year.

But whether the equipment is unloaded or fully loaded there are certain fixed charges (interest, depreciation, taxes, insurance, stand-by-costs, and the like) which are adding up continually. That is, any equipment is costing its owner money whether it is producing or idle. Now, during the hours that the equipment is well or fully loaded it is earning more money than it is spending, hence, nets a profit. The more nearly fully loaded it is, the more money—net—it is earning. Hence, it follows from an economic standpoint that it is desirable to keep all equipment as near fully loaded as possible during all of the hours of each year, that is, it is desirable to obtain and maintain a high load-factor.

A specific example showing how fixed charges per kilowatt-hour increase with decreasing load-factor, recited by Albert F. Strouse, is shown graphically in Fig. 1. This is based on an assumed plant having a maximum capacity of 100 kilowatts and an assumed cost of $10,000. A fixed charge of 12 per cent is assumed thus: interest 5 per cent, depreciation 5 per cent, insurance and taxes 2 per cent. The fixed charge per kilowatt-hour generated may be determined as shown in the example.

Example.—The yearly fixed charge will be: $0.12 \times \$10,000 = \$1,200$. If the plant operated at a load-factor of 100 per cent—8,760 hours per year, it would develop: 8,760 hours × 100 kilowatts = 876,000 kilowatt-hours per year. Then the fixed charge per kilowatt-hour would be: $\$1,200 \div 876,000$ kilowatt-hour $= \$0.00137 = 0.137$ cent, as plotted in Fig. 1 at *A*. Now if the load-factor is 25 per cent, only one-fourth the energy would be generated, that is, there would be generated 8,760 hours × 25 kilowatts = 219,000 kilowatt-hours per year. Then the fixed charge per kilowatt-hour would be: $\$1,200 \div 219,000 = \$0.00548 = 0.548$ cent, as plotted at *B*. That is, with a load-factor of 25 per cent the fixed charge has been increased four fold. The other points on the graph were determined by a similar process.

The effect of increased diversity of demand is to increase load-factor almost in direct proportion to the increase of diversity-factor. Thus, H. B. Gear states that, in Chicago, the load-factor of residence consumers individually is only seven per cent, while in groups it is about 23 per cent. The group load-factor of commercial lighting consumers is about 16 per cent and for general power users is about 17 per cent. However, when these three classes of consumers are combined, the load-factor of the load which they impose on the station is about 35 per cent during the winter months.

Effect of Load-Factor on Rates.

The effect of load-factor on central-station rates is a feature that should be understood. As the load-factor decreases, the cost of supplying energy must necessarily increase. A central station or utility plant must have sufficient capacity so that it can at any time supply the maximum demand of the system which it serves. Usually, the lighting load in the evening determines the maximum demand and, therefore, it is only for a few hours in the evening that the equipment is operating at the highest earning rate, or economic efficiency. During certain "off-peak" hours the equipment may be relatively idle. Therefore, when "off-peak" loads can be obtained, they are somewhat in the nature of a by-product. But they tend to increase the total load-factor of the system and thus decrease

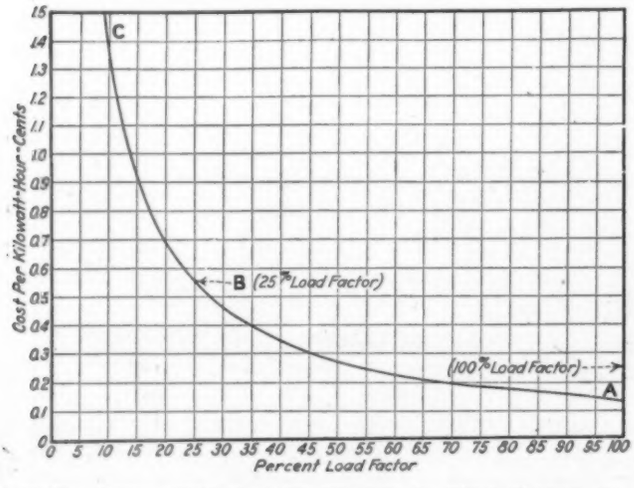


Fig. 1.—Curve Illustrating the Decrease In Fixed Charges Per Kilowatt-Hour As the Load-Factor Increases. Based on Plant of 100 Kilowatts Maximum Load Costing $10,000, With Fixed Charges of 12 Per Cent.

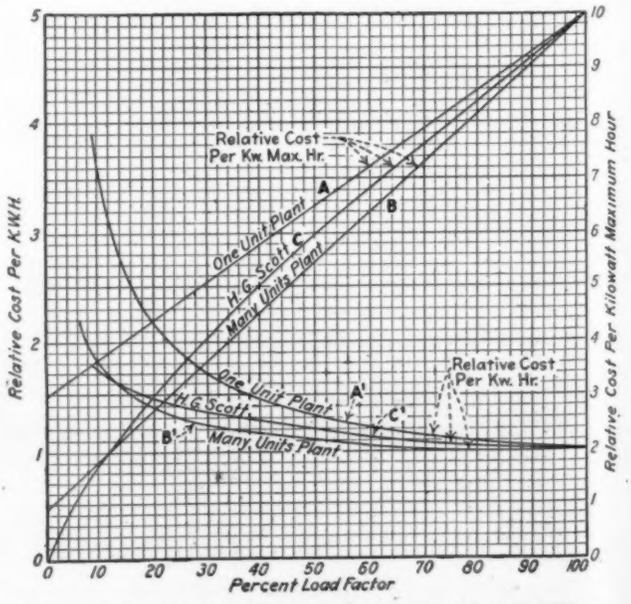


Fig. 2.—Curves Showing How Cost of Generating Increases as Load-Factor Decreases.

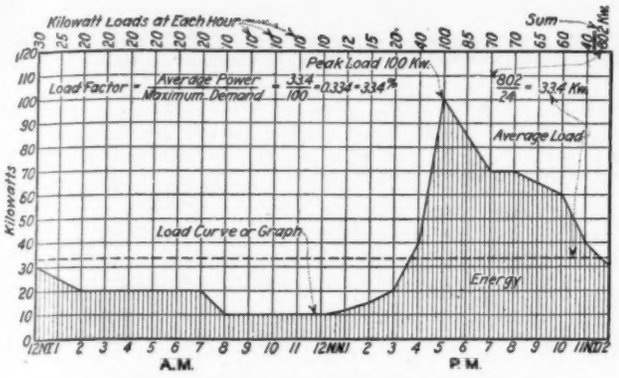


Fig. 3.—Method of Computing Maximum Demand From a Load Graph.

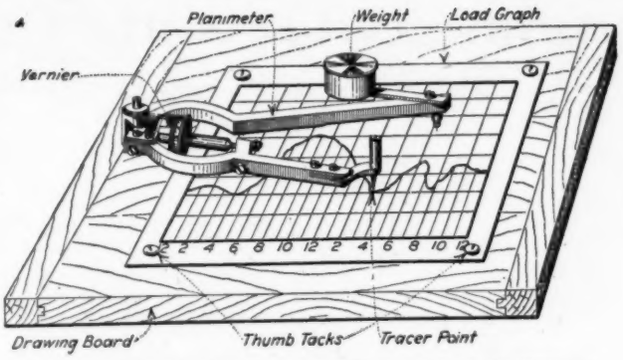


Fig. 4.—Finding Average Load From a Load Graph With a Planimeter.

the average cost per unit of energy. Hence, it is beneficial to all, for the utility company to seek and accept such loads at rates lower than those which it is necessary to charge for service which may be coincident with the load or maximum demand on the supply station. Fixed charges vary inversely as the load-factor, Fig. 1. The cost per kilowatt-hour as determined by the late H. G. Stott varies about inversely as the fourth root of the load-factor, Fig. 2. The significance of these facts will become apparent by considering the following examples.

Example—Consider a generating plant operating several units at an annual load-factor of 30 per cent and making energy for five mills per kilowatt-hour. What would be the cost per kilowatt-hour on a 60-per-cent load-factor basis. From graph *C*[1] the relative cost per kilowatt-hour at 30-per-cent load-factor= 1.35. Relative cost per kilowatt-hour at 60-per-cent load-factor=1.13. Then, the expected cost at 60-per-cent load-factor—$(1.13 \div 1.35) \times 5 = 4.2$ mills per kilowatt-hour.

Example—To illustrate the application of graphs *A*, *B* or *C* which may be used for estimating costs on the basis of the peak or maximum power load: Consider the same plant of the above example; the total annual cost per kilowatt-hour of operating the plant at 30-per-cent load-factor is 5 mills $\times$ 8760 = $43.80. But the annual cost per peak or maximum kilowatt per year = $43.80 \times 0.30 = $13.14. Now, referring to graph *C*: Relative cost per maximum kilowatts per year at 30-per-cent load-factor = 4.05. And, relative cost per maximum kilowatt-hour per year at 60-per-cent load-factor = 6.82. Then, the expected cost per kilowatt maximum hour, per year at 60-per-cent load-factor = $(6.82 \div 4.05) \times $13.14 = $22.10.

While the *"C"* graphs were used in the above examples, either the *"A"* or *"B"* graphs may be utilized in the same manner for conditions which justify their application.

Calculations from Load Curves.

To determine the average power from a load curve, either the graphic method illustrated in Fig. 3 and in the following example, or that involving the use of a planimeter (Figs. 4, 5, 6 and 7) described later, may be used. The general procedure is quite similar to that used in obtaining the mean effective pressure from an ordinary steam-engine indicator diagram.

The rule for the graphic method of finding the average power from a load curve is to scale or read from the load graph, the power at the ends of suitable, equal time intervals over the entire time comprehended by the graph. Then add these power values together and divide their sum by the number of periods into which the entire time was apportioned. The result will be the average power or average load.

The number of time intervals into which the entire time should be divided is determined by the contour of the graph and by the degree of accuracy desired. In general, the greater the number of intervals taken, the more accurate will be the result. However, where the contour of the graph is quite regular and it comprehends 24 hours of time, as in Fig. 3 the result will usually be sufficiently accurate for practical work if one-hour intervals are assumed. It is seldom necessary to use intervals smaller than a half hour on a graph comprehending a 24-hour period. Where the contour of the graph is extremely irregular and comprehends a short period of time, it may be desirable, to insure sufficiently accurate results, to use 15-minute, 5-minute or even 1-minute intervals.

In determining the average power from a load graph with an ordinary polar planimeter (Figs. 4 and 5) ascertain the actual area of the portion within the graph, which represents energy in kilowatt-hours, in square inches by using the planimeter. Then divide this area by the actual length of the graph in inches. The quotient thus obtained will be the average height or length or ordinate of the graph, in inches. Then find by scaling, along the ordinate axis of the graph, the kilowatt equivalent of this average height. This kilowatt equivalent will be the average power in kilowatts.

If the planimeter which is being used is not sufficiently large to indicate the area of the graph under consideration in one sweep, divide the total area, with vertical pencil lines, into three or four sections which need not be equal; find the area of each section and then add all of these partial areas together

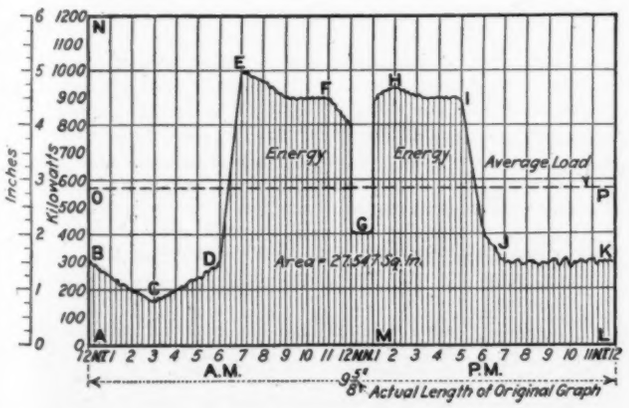


Fig. 5.—Example of the Determination of Average Load Using a Planimeter.

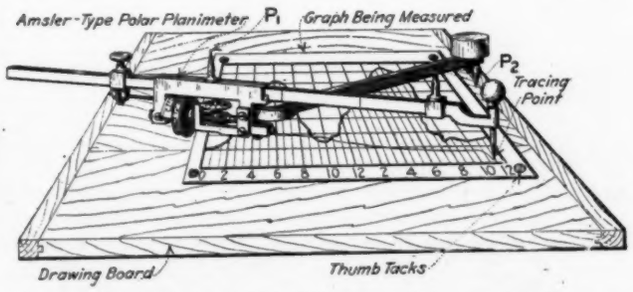


Fig. 6.—Amsler-Type Polar Planimeter Used in Measuring the Area Within a Load Graph.

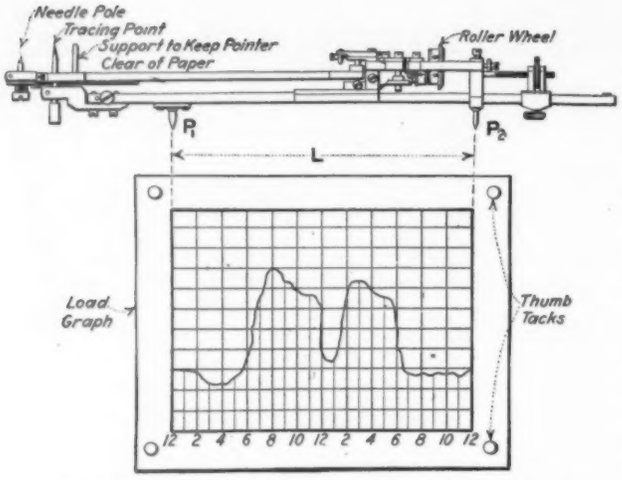


Fig. 7.—Method of Setting Planimeter So That It Will Read Mean or Average Height of Graph.

to obtain the total area. Detailed directions for using planimeters accompany each instrument or may be found in books on steam engine or indicator practice.

Example—Find the average power from the graph of Fig. 5 with a planimeter and compute the energy thereby represented. *Solution*—By using the planimeter it is found that the area (ABCDEFGHIJKLMA) within the graph, representing energy, is 27.547 square inches. (The cut shown is only about one-third the size of the original graph on which this example is based). The length, *AL*, of the graph is found, by scaling, to be 9⅝ inches. Hence, the average height or ordinate of the graph is: 27.547 ÷ 9.625 = 2.86 inches.

It will be found, by scaling along the ordinate *AN*, that 2.86 inches is equivalent to 572 kilowatts, that is, one inch = 200 kilowatts. Hence, the average power is 572 kilowatts as indicated by line *OP*, which has been drawn in on the sheet. Furthermore, the energy represented by the shaded area within the graph is equal to: 572 kilowatts × 24 hours = 13,728 kilowatt-hours.

If it were known at the start that the energy represented by the shaded portion within the graph was 13,728 kilowatt-hours, the procedure to determine the average power might then have been thus: 13,728 kilowatt-hours ÷ 24 hours = 572 kilowatt-hours, which is the average power or load.

To determine the average power from a load graph with an Amsler-type polar planimeter (Figs. 6 and 7) the process is simpler than that just described because, with this instrument, it is unnecessary to scale the length, representing time, of the graph. By performing a simple subtraction and division the average height (which is proportional to the average power) of the graph may be obtained directly as follows: The planimeter is held upside down and points P_1 and P_2 are so adjusted that the distance between them is exactly equal to the length L of the load graph. Then the arm is clamped and the planimeter used in the usual way. However, instead of indicating the area, the mean height of the graph may be ascertained from the readings. Thus, with one make of instrument, the difference between the readings at the beginning and at the end of the operation divided by 0.4 will give the mean height of the graph in inches. *Example*—(Second reading, 4.786, — first reading, 4.322) = 0.464. Now 0.464 ÷ 0.4 = 1.16, which is the mean height of the diagram in inches.

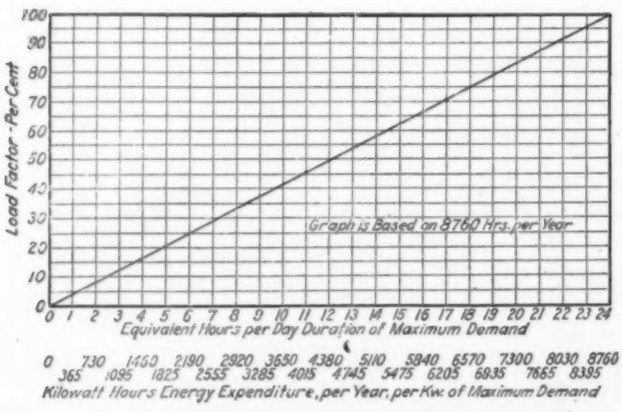

Load Factor - Per Cent
Graph is Based on 8760 Hrs. per Year
Equivalent Hours per Day Duration of Maximum Demand
0 730 1460 2190 2920 3650 4380 5110 5840 6570 7300 8030 8760
365 1095 1825 2555 3285 4015 4745 5475 6205 6935 7665 8395
Kilowatt Hours Energy Expenditure, per Year, per Kw. of Maximum Demand

Fig. 8.—Graph Showing Relation of Load-Factor to Equivalent Hours' Use of Maximum Demand.

An example of computing the energy delivered or consumed by a given installation of known load-factor when the maximum demand is known is as follows:

Example—An annual load-factor of 25 per cent (Fig. 8) implies a six-hour use per day of the maximum demand and an annual energy expenditure of 2,190 kilowatt-hours per kilowatt of maximum demand. Thus if a certain installation has a load-factor of 25 per cent and its maximum demand is 42 kilowatts the annual energy expenditure involved is 42 × 2,190 = 91,980 kilowatt-hours.

To determine the maximum demand for use in computing a load-factor, the most desirable and accurate method is to use the reading of a maximum-demand indicator where such is available. Where load graphs are available, the maximum demand can be readily taken from them. The record of a graphic wattmeter is useful in this connection. A load graph may be plotted from the readings, taken at equidistant time intervals, of an indicating ammeter or wattmeter and the maximum demand may then be ascertained from the graph thus plotted. The examples herein recited illustrate the general methods that are employed.

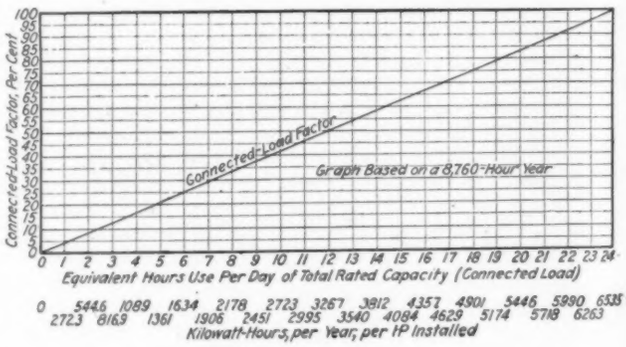

Connected-Load Factor, Per Cent
Connected-Load Factor
Graph Based on a 8,760-Hour Year
Equivalent Hours Use Per Day of Total Rated Capacity (Connected Load)
0 5446 1089 1634 2178 2723 3267 3812 4357 4901 5446 5990 6535
2723 8169 1361 1906 2451 2995 3540 4084 4629 5174 5718 6263
Kilowatt-Hours, per Year, per HP Installed

Fig. 9.—Graph Showing Relation of Connected-Load-Factor to Equivalent Hours Use of Connected Load.

A graph for quickly computing the kilowatt-hour energy consumption of an installation when the connected-load-factor and the connected load are known is given in Fig. 9. The application is explained in the following examples. This graph may also, when the connected-load-factor is known, be applied conveniently for determining, by inspection, the equivalent hours used per day of the total connected load.

Example—In a certain plant the total rated capacity of all the motors is 60 horsepower. The connected-load-factor is known to be 25 per cent. What will be annual energy consumption? *Solution*—The graph of Fig. 9 indicates that, with a connected-load-factor of 25 per cent, the annual energy consumption will be 1,634 kilowatt-hours per horsepower installed. Hence the annual energy consumption will be: 60 horsepower × 1,634 = 98,040 kilowatt-hours. It will also be noted from Fig. 9 that a connected-load factor of 25 per cent is equivalent to a six-hour use per day of the total capacity or connected load installed.

Example—If the connected-load-factor of an installation is 40 per cent it means that the energy consumed by this installation is the same as that which would be consumed by all of the connected load if it were operated at rated (name plate) output for 9.5 hours per day (see Fig. 9) every one of the 365 days of a year.

The Limitations of Public Ownership

Under Our Present Political Conditions Public Ownership of Utilities Imposes a Burden on the Taxpayer—Sale of Energy to Municipalities a Pertinent Question

By THOMAS R. HAY
Duquesne Light Company, Pittsburgh.

THE modern central station has come to be a public utility in the broadest sense of the word, in many cases doing an interstate business, and, therefore, subject not only to direction and control by the state, but also by the federal government. In order to give the best possible service at the lowest price, and also on account of the peculiar conditions entering into the manufacture and sale of the product, all public utilities are of necessity natural monopolies, and public service regulation by commission is a recognition by the state of the monopolistic character of such enterprises. The favorable showings made by the central-station companies in reducing the cost of electricity to the consumer and in increasing the efficiency of their service is due mainly to a reduction in the capital expenses and to lower operating costs. The importance of the service rendered by a central station as an economic factor, and, in fact, as a daily necessity, is indicated by the volume and diversity of its business. Such economic agents are necessarily always undergoing great changes, with an accompanying increasing tendency toward consolidation with a view to concentration of the source of supply from which radiate wide spread transmission lines to convey the electric energy to its several and diversified points of application. More and more these lines are crossing state lines and serving various municipalities, thus being subject, as before mentioned, to state as well as Federal regulation. It is not to be presumed, however, that any regulation, however discriminating and harassing, will prevent the proper and continued development on an increasingly larger scale of the central-station industry, the great benefits of which have only commenced to be realized and appreciated at their real value. It is not sufficient to know that the concentration of the power supply avoids economic waste and creates a new factor in civilization, but it is imperative that the public must also realize that in order to efficiently and continuously carry on the work that has been started, interference by regulating commissions should be temperate, intelligent and based on logical premises and not on whim or fancy or on the political considerations of the moment. Regulation, properly and intelligently exercised, should be and is of great value to the community and also to the central station, as by standardizing its rates and practices a more equitable situation as between producer and consumer has been brought about. In the past policies were in force and so carried out that they worked injustice to the consumer and caused the producer to be generally regarded with odium. Rates were not standardized and when the exigencies of the situation seemed to warrant, a rate was quoted that would get the business, thus discriminating as between consumers and without regard to the amount of electricity used.

Handicaps of Public Operation.

Municipal ownership and operation of public utilities, so far as the central station is concerned, has in the past been confined to the cities and has not been carried on in the extensive manner generally practiced by the up-to-date privately owned and operated corporation. This plan of operating the modern public utility by popularly chosen officials meets with a serious and economically destructive handicap from the start. It is difficult to find competent men for private employment with all its investigations and safeguards, but in the public service none of the safeguards against inefficiency exist. Under our present system of frequent rotation in office, party politics, under one name or another, is the determining consideration. However efficient an official may be, the mere fact that he does not accept one party affiliation rather than another is sufficient cause for his removal from office and the substitution for the time being of another man who bears the right party designation. The efficient and honest official is ousted from office at the very time when his effectiveness in the public service is at its maximum. Nothing requiring special skill or ability can survive such a system. Unnecessary men—often inefficient and incapable men—are added to the payroll merely to pay a political debt by gratifying the personal caprice of the individual affected, and regardless of qualifications or necessity. Duplication—as in Cleveland for example—on an economically destructive scale takes place, for all of which the public citizen (the taxpayer) pays in the long run. Taxation for the purpose of revenue is one of the basic principles of any government. With a municipally owned and operated utility, while it is of course possible to regulate the price of the products for sale and to bring this price below that charged by a potential competitor, this price for service must provide an income that makes possible an economic return, or else the deficit must be made up by the taxpayer. The public possesses the power to regulate taxation and can at any time adjust the payments of the corporation to a fair percentage of the value. Through control, by regulation and taxation, of the price of the service rendered the public possesses the power of preventing any kind of abuse, as it can always compel the maintenance of an excellent standard of quality of service.

Sale of Energy to Municipalities.

The sale of energy by the central station to municipalities, while a comparatively new one, is, nevertheless, assuming such proportions that it must be given serious consideration. As the tendency toward consolidation of the smaller plants into larger systems supplied from one central point increases, and as the lines radiating from this central point are extended, the central station is confronted with the difficulty of being unable to sell its product in towns where municipal lighting systems and municipally owned water-works systems are in operation, on account of the fact that the cities owning these plants are usually unwilling to grant the central station a franchise to enter the town, for fear that it will prove a serious competitor. Where it is impossible to obtain a franchise the only alternative is to sell energy in bulk to these municipally owned systems, the municipality to retail this energy to lighting and power users.

This opposition of the municipality to the granting of a franchise to the central station is usually due, not to any consideration of cost and efficiency, but to individual opposition by those particularly interested in the maintenance and continuation of the municipal plant. As taxpayers, the citizens of the municipality are vitally interested in such a change in operation and mangement. The granting of a franchise to the central station for the operation and upkeep of the municipal system and the sale of electric

energy will release the tax payer of all expenses incident to the operation and upkeep of such a system, and will enable them to purchase the desired electric energy at a reasonable and fair rate, approved by the public service regulating commission.

When the municipality is unwilling to grant the central station a franchise contemplating the ownership, operation and upkeep of the feeder and distribution system within the limits of the borough, but is willing to purchase the energy on a wholesale basis and to retail it within the corporate limits, the municipality is under the necessity of attending to all details of local management and organization, and of providing for the maintenance of all lines and accessory apparatus within the corporate limits. From the central-station standpoint, and from the point of view of revenue and average rate, this type of business is extremely profitable, as the commercial cost in serving municipalities is extremely small. An entire community is represented by one meter, by one transformer installation and by one account. As a general rule the bills are paid promptly, there are few complaints from the municipality to the central station, and the cost of holding the business, once secured and properly served, is practically nothing. When supplying such service to municipalities it is generally possible to obtain a satisfactory franchise, which, while prohibiting competition with the municipality, will permit the securing of such large power business as may be available.

In soliciting this class of business, especially in the case of the smaller municipalities, it is not usually difficult to convince city councils that the central station, with its ample resources, central plant and lower cost of service is in a better position to furnish continuous, adequate and satisfactory service at a fair price, than is the municipality with its relatively small plant and resources for enlargements and extensions to meet increasing demands.

The successful operation of a municipal system depends upon reliable and economical power, and the ability of the community to expand quickly and give employment to a greater number of people depends upon the elasticity, reliability and economy of this power service. Public service systems municipally operated are notoriously inefficient, uneconomical and unreliable, and such service has not demonstrated its ability as a factor to keep the community in which it operates in the front. The greater the prosperity of the community, the greater will be the success and comfort of the public and of the manufacturers residing or located in such a community. Communities with municipally operated utilities are not attractive to industries seeking location and whose very existence depends on the character of electrical service rendered them. The prosperity of every resident in a community is dependent on the successful and continued operation of the manufacturing concerns located in that community.

Restrictions of Public Operation.

Another formidable objection to municipal ownership which exists in some states, and which is not always considered, is the necessity of restricting the operations of a municipal plant to municipal territory, with respect both to the supply of consumers and access to sources of power such as water power. Private companies are increasingly finding it desirable to extend transmission systems over state lines, and to consolidate the generation and distribution of electric energy for serving large territories. This is frequently not feasible under municipal ownership. These restrictive features act to prevent a municipal plant from realizing economies and reductions in generation costs by preventing the use of large units operating at high load-factors.

The chief causes of municipal ownership are not due primarily to any real belief on the part of the community that municipal ownership and operation is preferable to private ownership and operation, but rather to real or supposed high rates, politics, poor service and indifference to public requirements. In most cases municipal plants are not agitated or installed because they are a good thing, but because it is generally believed that the management and operation could be no worse than that conducted under private ownership. In the majority of cases agitations for municipal ownership are based on the rates for service. Rates vary with localities, and where it is found that one town is enjoying a lower rate than another, a case for municipal operation may be conceived.

The average user has no conception of the conditions underlying the generation, transmission and application of electricity, and of the manifold details of such work; nor has he any conception of the technical terms and details of the industry, or of the basis and method of rate making. Publicity and right treatment of the public by the central station is the logical method of educating the public and of obviating the chance of municipal agitation. The public has a right to be taken into the confidence of the central station to the extent of being informed something of the reason for the various rates and of the basis of the making of these rates. This publicity should be continuous, and should not be taken up only when agitation has forced such a step. It takes four years of college to learn the basic fundamentals of a chosen career. A three or four weeks' publicity campaign cannot make clear to a technically uneducated public matters that should have been brought out by a campaign of education carried on from year to year. The most important part of this education should be to make clear to the public why comparisons of rates existing in different localities are valueless.

Need For Educating the Public.

The central station loses a great advantage if it waits to be attacked. Public education must go on all the time. Forestalling agitation by intelligent and understanding education certainly will act to reduce the cost of securing municipal business, as well as holding that already secured. Securing public good-will is not accomplished by merely giving good service and keeping still. The central station that lets its public know what is going on and that tells of its good deeds, is the one that will easiest and longest hold the community good-will, and that will sell its service most easily and at the least cost.

If what experience we may have had for our guidance has not taught us that municipal enterprise, whether city, state or federal, cannot be or are not conducted as economically and efficiently as under private ownership, it should yet seem plain that this must necessarily be true, for the chief incentive of all business is gain, and no business can be permanently profitable which fails to serve its patrons effectively or is heedless of the urgent need of economy.

With a municipally operated enterprise no such incentive exists, and no need of economy is plainly apparent. It is not the business of a municipality, state or government to make money, and while officers selected may be, and generally are, quite as honest as the officers or heads of private business enterprises, they are not expected to earn money, and where their duties involve its expenditure, they are not of necessity concerned over the fact that the department over which they preside is not being operated at a profit; since appropriations may be confidently looked for in case of a deficit. As their incomes are fixed and their tenure of office is frequently uncertain, they lack the spur which the promise of increased income as a reward for efficient work affords. They cannot count upon a term of service long enough to make worth while a complete mastery of a business so technical and so highly specialized as the manufacture and sale of electricity.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Salina's New Slogan Sign Creates Good Will for Central Station and Electrical Advertising.

An indication of the progressive spirit of the citizens and municipality of Salina, Kan., is shown in the recent installation of a large electric sign costing $3,000, towards which the Salina Light, Power & Gas Company has contributed $500. The power company has agreed to maintain and operate the sign from dusk until midnight, furnishing the necessary energy free.

The sign is in the shape of an arch, measuring 38 feet long, and on the side facing the station are the words "Salina, Your Opportunity, Welcome," and on the other side reads "Salina, Union Station, Come Again," the whole surrounded by a border of colored lights.

The erection of the sign has been responsible for an appreciative feeing towards the electric company, which was largely responsible for this latest addition to the city's attractions, and as a consequence orders for electrical signs are being received from local merchants, who are seeing the value of light as a producer of business. Festivities marked the first illumination of the sign recently, and the city glowed with enthusiasm.

Atlanta Company Finds That Paying of Commissions Stimulates Appliance Sales.

On January 1, 1917, the Georgia Railway & Power Company, Atlanta, Ga., put into effect a commission sales plan for appliance salesmen. This plan allows a commission on all electrical apparatus sold by the salesman, the commissions and principal rules governing payment being set forth in the following pararaphs. Speaking of the advantages of the commission plan of payment for appliance salesmen, C. A. Collier, assistant to the sales manager, says: "We find that this not only enables the salesman to earn some additional compensation, but that it also tends to increase the sale of electrical appliances through local contractors, due to the fact that the salesman makes it a point to mention electrical appliances to each and every prospect upon whom he calls.

"While this program has been in effect now a little over three months, we are very much pleased with the results obtained and fully expect to find that the work of the salesmen along this line will have a great accumulative value."

Following are the principal conditions which govern the payment of commissions:

(1) In order for the salesman to obtain any commission on an article, he must bring in a bona fide order. In other words, no orders taken in the contract department either in person or over the telephone will be credited to any of the salesmen.

(2) Should an article, after delivery, be returned by the customer for any reason and no other article substituted for same, then in that event the solicitor will receive no commission.

(3) In order to obtain commissions, the articles must be sold at the prices set forth from time to time by the sales department. Articles sold for less, will have no commission value.

(4) No commissions will be given on articles sold by contracting firms in the City of Atlanta. All sales must be made through the Georgia Railway & Power Company in the regular routine way.

(5) At the end of each month, the salesmen shall prepare a list of the articles sold by them in the previous month, giving the name of party to whom the article was sold, number of articles, and price obtained for same.

Name of Apparatus:	Commission
Chafing Dish	$0.50
Coffee Percolator	0.50
Factory appliances:	
Glue pots.	
1-500 Watts	1.00
501-750 Watts	1.10
751-1000 Watts	1.20
1001-15000 Watts	1.50
1500-and over	2.00
Solder pots	0.75
Sealing wax pots	0.50
Soldering irons	0.50
Book-binding heaters	0.50
Other appliances for industrial use, not otherwise mentioned	2 points per 100 watts
Grill	0.40
Old House wiring	1.00
Air Heaters—	
0-500 Watts	0.35
501-1000 Watts	1.00
1001-2000 Watts	1.50
2001-5000 Watts	2.00
Water Heaters—	
One pint	0.35
One quart	0.40
Two quarts	0.50
Heating pad	0.40
Irons—	
Domestic	0.50
Curling irons	0.35
Industrial flat irons—	
500-1000 Watts	0.75
Over 1000 Watts	1.00
Laundries (residence)—	
Connected load 1000 Watts	3.00
Connected load 1000-1500 Watts	5.00
Connected load 1501-3000 Watts	7.50
Ovens (not ranges)—	
0-500 Watts	1.00
500-1000 Watts	1.50
1000 and over—5 points per $1.00 of revenue.	
Ranges—	
Up to 2000 Watts	4.00
2001-4000 Watts	7.50
4001-10000 Watts	10.00
10000-and over—25 points per 100 watts.	
Sterilizers—	
0-500 Watts	0.50
500-1000 Watts	0.75
1000-and over—1 point per 100 watts.	
Samovars	0.40
Sewing-machine motors	0.50
Toasters	0.50
Uni Set	0.50
Portable vacuum cleaners	2.00
Vibrators	0.50

These commissions do not affect the bonus offered by the company for contracts for wiring old houses.

Large Power Contract Secured by Denver Company.

A contract for an initial load of 200 horsepower which will later be increased to 600 horsepower, has just been closed by the Denver (Colo.) Gas & Electric Light Company with a local chemical company, and the company anticipates securing further business with the firm in the shape of electric furnace work.

Another installation reported is for an iron works. The load will be 50 horsepower, with a proposed increase to 120 horsepower very soon.

In order that the sewing-machine campaign, which has been arranged for June by the Denver Gas & Electric Light Company, operated by Henry L. Doherty & Company, may be productive of good results, each salesman will be expected to qualify as an expert seamster.

HARRISBURG COMPANY SECURES 1,901 HOUSE-WIRING CONTRACTS IN SPECIAL CAMPAIGN.

Two Separate Campaigns Conducted at Low Cost Also Result in 976 Other New Customers.

Last year in Harrisburg, Pa., the Harrisburg Light & Power Company connected to its lines approximately 2,000 more new customers than it had ever secured in any previous year. Harrisburg is a city of 64,000 population and for years the central station has been active in the pursuit of business, so that this phenomenal gain in customers becomes an interesting achievement, and the conditions under which the company's special house-wiring campaign was conducted will be of general interest to central-station men and contractors.

In an account of this campaign in the *Bulletin* of the United Gas & Electric Engineering Corporation, C. M. Kaltwasser, general manager of the Harrisburg company, says that the company was confronted by a situation which seemed to call for the most energetic measures and the results have certainly justified the means.

For Harrisburg is a very conservative Pennsylvania city that has always been predisposed to gas for lighting. The gas company was established for many years before electric service became available, and gas has maintained its popularity very largely. Naturally, electricity has become the standard for all modern buildings and business has grown and developed through the years most satisfactorily. But the fact remains that hundreds of homes of people who could well afford to use electric light still continued to depend entirely on gas, because that was what they had always used; and in addition, of course, there was that other class of smaller houses that offered a very large opportunity for business if the company could overcome the obstacle of wiring cost.

The Harrisburg company maintains a wiring department and both this department and the local contractors had been unsuccessful in securing business from these two classes of customers to the extent that was felt ought to be possible. It was therefore decided, about the first of last year, to organize a special house-wiring campaign on rather radical lines. In short, the company offered to install four outlets on the first floor of any house without charge, provided that the job was done in open work. If concealed work was substituted, a small charge would be made, and if additional outlets were desired these were contracted for at regular prices. Therefore, the offer to install four open-work outlets without charge became in effect an advertising feature of the campaign. And additional outlets and concealed work and the sale of appliances was counted on to actually put the whole campaign on a paying basis. The offer was extended to 250 houses, beginning on the fifteenth of March, 1916.

In detail, the proposition was to wire free of charge on the first floor, four outlets, open work, complete with drop cord and sockets, or to charge $2 for the four outlets if the customer desired concealed work. The salesmen were instructed, however, to persuade customers to have the work concealed, with the result that out of a total of 1,901 contracts completed only one job was open work.

The only conditions made in connection with these campaigns were that the prospective customer must be on the existing lines, and that the four outlets wired would have to be located on the first floor. In case there was room for only three outlets on the first floor and it was desired to place one outlet on the second floor, then there was an additional charge equal to the increased cost made necessary on account of placing such outlet on the second floor. All outlets above four were charged for at the following prices:

$2.50 per light outlet.
$2.50 per switch outlet.
$1.00 for S. P. push button switch installed.
$1.25 for 3 P. push button switch installed.
$1.25 for flush receptacle.
$4.00 for cellar light on snap switch complete.

Salesmen were paid $1 for each contract which they secured under this special wiring proposition.

The company was particularly desirous of working together with the contractors in every way and enlisting them in the campaign, so that it might also result in benefit to them. The purpose of the campaign was to open up that mass of old house wiring that for so long had been inaccessible and by connecting up some hundreds of new customers advertise electric service widely and make immediate market for more wiring and appliance sales, in which the contractors would secure their full share. The company realized also that the amount of business it would secure would swamp the wiring department and that the contractors were vital to any big success.

An agreement with the local wiring contractors was, therefore, entered into by which they agreed to wire the first four outlets, in concealed work, including meter loop and inspection fee for $8. Of this amount, the company paid the contractor $6 and the customer paid $2 direct to the contractor, as provided in the contract. These contracts were taken under a special form of agreement. The company went directly to the tenant and secured his signature after which the consent of the owner was obtained. And this proved a most effective point of entry.

So the first campaign began on March 15 and ran till June 30, on this basis. Then on September 1 a second similar campaign was opened and this one ran until November 10. However, the company was only able to secure co-operation on the part of the local contractors during the first campaign, as they claimed that they could not make any money by doing the work at the price paid them. While this was undoubtedly true, yet the belief was that the contractor would make his profit on the additional wiring which it would be able to secure from the customer, and also from the sale of fixtures and appliances. Subsequent experience proved that this contention was correct, for it happened in over 500 cases where the customer first signed up for four outlets, that he later increased his contract to embrace additional wiring, and also bought fixtures and appliances from the local contractors.

The company completed during these two campaigns 1,901 jobs, aggregating 10,881 otulets, or an average of six outlets per job, the maximum number of outlets wired on any one job under these campaigns being 28.

REPORT ON SPECIAL WIRING CAMPAIGNS CONDUCTED IN HARRISBURG.

	First Campaign	Second Campaign	Aver.	Total
Total number of contracts completed	966	935	.....	1,901
Total number of outlets installed	5,415	5,466	.....	10,881
Average number of outlets per job	6	6	6	.....
Paid contractors for installing 430 special wiring contracts: 328 on first and 102 on second campaign	$2,017.29	$617.90	.....	$2,635.19
Cost of cord drops supplied contractors	864.28	71.69	.....	935.97
Total cost of 430 contracts installed by contractors; 328 on first and 102 on second campaign	2,811.57	689.59	.....	3,571.16
Cost of labor and material, installing 1,471 contracts by company's wiring dept. 638 on first and 833 on second campaign	7,371.98	9,421.69	.....	16,793.67
Commission paid salesmen for securing above contracts; 966 on first and 935 on second campaign	908.35	821.45	.....	1,729.80
Total cost of campaign	11,161.90	10,932.73	.....	22,094.63
Amount received from customers for wiring	5,494.70	5,800.27	.....	11,294.97
Net cost of campaign	5,667.20	5,132.46	.....	10,799.66
Av. net cost per job compl't'd	5.87	5.49	$5.68	.....
Average cost of actually wiring four outlets, including labor, material and salesman's commission	8.24	8.48	8.36	.....
Amount paid by customer for wiring four outlets	2.00	2.00	.....	.....
Av. net cost of four-outlet job	6.24	6.48	6.36	.....
Total electric revenue received from spring campaign from April 1, 1916, to Jan. 31, 1917	8,915.44	.....	.....	.....
Total electric revenue received from fall campaign from Sept. 1, 1916, to Jan. 31, 1917	.....	3,266.91	.....	.....
Total electric revenue received from both campaigns to Jan. 31, 1917	.....	.....	.....	$12,182.35

The campaign itself was responsible for 1,901 new customers, but there were in all 2,877 new customers connected during the year, and a large amount of other wiring was stirred up at the same time. People got interested in the subject and had additional outlets installed and better fixtures put in because everybody was doing it. In fact, ever since the close of the campaigns, the company has been continually receiving orders from customers connected under the special wiring plan, for additional wiring and fixtures.

No extensive advertising was done in connection with these campaigns, and the newspaper advertising was only slightly increased over the usual amount of advertising that this company does. The only special advertising was the distribution of 17,000 handbills, which cost $600.

Although it was endeavored to keep track of the appliances sold to the customers taken on under the campaigns, it was found practically impossible to do so because a great many of the sales were cash sales, and there was no way of determining just what appliances were sold to customers secured under the campaigns. In addition to such sales by the Harrisburg company, a great many appliances were sold by local contractors, all of whom agreed that their merchandising business improved considerably as a result of these campaigns.

A little study of the accompanying detailed tabulation will be interesting to anyone who cares to analyze this campaign with an eye to costs and profits. These figures show all the items that entered into the net cost of the work and also the revenue derived up to January 31, 1917, from the customers connected under this special campaign offer. These figures embrace both Harrisburg and Steelton, which is a suburb. It should be noted in this connection, that the company has already derived from these consumers sufficient revenue to cover the entire cost of the campaigns, the revenue to January 31 bing $12,182.35, and the net cost only $10,799.66.

New Residence Rate Offered in Louisville to Encourage Appliance Use.

An attractive two-step rate reduction proposal has just been announced by the Louisville (Ky.) Gas & Electric Company to its residence consumers, effective May 1. It provides for a minimum charge at the usual rate, with all consumption in excess of this amount at a net rate of three cents per kilowatt-hour. The terms are stated concisely as follows:

(1) First six kilowatt-hours per room per month at eight cents per kilowatt-hour. All in excess at 3.157 cents per kilowatt-hour. A five-per-cent discount is allowed.

(2) Applicable only to residences for domestic purposes exclusively and only when consumer applies for and signs special application form.

(3) This reduced rate is conditioned upon the consumer guaranteeing to the company a consumption during each month of not less than three kilowatt-hours per room per month at eight cents per kilowatt-hour.

(4) Contract period not less than one year.

It is understood that this is the first one-step quantiative reduction that has yet been offered, although there are three-step reductions in effect in some cities. The objects are to increase the consumption and improve lighting conditions by influencing persons who are occupying poorly lighted homes to use more energy, and also to encourage the use of motored appliances for domestic purposes, without the company being required to install separate meters and connections where the power rate would apply. Private electric-vehicle charging outfits would come under this head.

Similar concessions are made to consumers residing in territory lying outside of the city and served by the Louisville Gas & Electric Company, except that the charge for the first six kilowatt-hours is nine instead of eight cents.

In connection with the announcement the company made the following statement to the public:

"There are in use today in Louisville about 15,000 electric irons and the same number of electric fans, and it is the opinion of the company that there should be almost as many electric vacuum cleaners, electric coffee percolators, toasters, washing machines and many other electric labor-saving devices in use. The officers of the company believe that by offering this very low rate for excess consumption, the sale of appliances of this sort will not only be stimulated but that those already owned will be used much more generously."

Boston Edison Company Features Sewing-Machine Motors.

The Edison Company of Boston is featuring as its

Street-Car Card Used in Boston Edison Campaign.

"April special" the Sew-E-Z Hamilton Beach sewing machine motor, a reproduction of the advertising street-car card appearing herewith.

The small payment of only one dollar places the motor in the home. The motor fits any make of machine and is readily attached.

Course on Central-Station Advertising Arranged.

A series of discussions on the art and value of advertising, presented in the form of dialogues between characters borrowed from the famous Rollo books, is being offered to Class A and D members of the New England Section, N. E. L. A., by the advertising and publicity committee, Willard Hall, chairman.

The subjects dealt with are: Principles of Selling, Principles of Advertising, The Mailing List, Circular Letters, Folders, Newspaper and National Advertising, Lantern Slides, Window Displays, Car-cards and Bill-boards, Using the Telephone.

The series will be sent free to member companies, and non-members may procure the same for $3.

Premium Offer Stimulates Nashville House-Wiring Campaign.

Special inducements are being offered by the Nashville Railway & Light Company, of Nashville, Tenn., to bring about the wiring of old houses. The offer is made as an appeal to homeowners, landlords and renters, and is expected to reach a large majority of those who have not been secured in previous campaigns. The contracts provide that the wiring of the house may be paid for in 12 monthly installments, ranging from $1.10 for a three-room house to $2.60 for a ten-room house, the first payment not to be paid until June 1. The electricity for the first month is furnished free of charge. In addition a chandelier is given as a premium.

Central-Station Costs in Nashville Show Present Rates Are Equitable.

That popular ignorance of rate-making is usually a large factor in a campaign for public ownership of lighting plants has again been illustrated at Nashville, Tenn., where agitation has been begun for the enlargement of the city's power plant and extension of its lines to furnish commercial service. The legislature has authorized a bond issue of $1,000,000, subject to a vote of the people, for this purpose.

The basis of the agitation has been a complaint against the rates for residence lighting, which are as follows: 11 cents per kilowatt-hour for the first 200; 8 cents for the next 600; 6 cents for the next 1,700; 5 cents for the next 2,500 and 4 cents for excess use. A prompt-payment discount of 10 per cent virtually makes the minimum charge 10 cents per kilowatt-hour.

Despite the allegation of high profits from this source, an investigation made by the Engineering Association of Nashville has disclosed that residence lighting is, as usual, a losing proposition. The commercial lighting rate, based on 50-watt equivalents, is 11 cents per kilowatt-hour for the first three units; 7.2 cents for the next 3; and 3 cents for the excess consumption. The small-power rate ranges from 9 cents per kilowatt-hour to 5 cents, while the large power rate includes a demand charge of $1.25 per kilowatt connected plus charges ranging from 4 cents for the first 500 kilowatt-hours to 0.7 cent for an excess of 14,000 kilowatt-hours. A discount of five per cent is given power customers. There was no complaint made regarding any of these charges.

It is shown that the average cost per month of each residence meter, excluding the actual cost of the current used, is $2.22, while the average receipts are only $1.70.

In making these charges, the overhead lines, meters and transformers are valued at $2,000,000, the annual charges being 6 per cent for interest and 4 per cent for depreciation. The charges are divided according to the number of meters on each class of service. Underground lines are valued at $450,000—Nashville being a city of rock ground—and 5 per cent of the annual charges is charged against the residence service, 75 per cent against commercial lighting and 20 per cent to power, in proportion to the number of meters in the underground district. The power station is valued at $1,500,000 and interest charges are proportioned in accordance with the connected load for the various classes of service. The depreciation charges are divided—as the most convenient, although not the most exact method—in proportion to the actual consumption of the various classes of service. This method reduces the cost to the lighting consumer. Operating costs, excluding that for production of current, and taxes are proportioned according to the number of meters.

The various costs are as follows:

Divisions	Residence Lighting	Commercial Lighting	Power
Number of meters	10,500	3,500	875
Overhead lines	$114,300.00	$38,100.00	$47,600.00
Underground lines	2,025.00	30,375.00	8,100.00
Power station	19,530.90	28,822.40	18,699.00
Operating (excluding current)	127,080.00	42,300.00	10,625.00
Taxes	17,270.00	17,270.75	34,541.50
Total	$280,205.90	$154,668.15	$119,515.50
Cost per meter per month	$2.22	$3.69	$16.15
Receipts per meter per month	1.79	7.63	27.09

Chattanooga Conducts House-Wiring Campaign.

The Chattanooga (Tenn.) Railway & Light Company has begun a comprehensive house-wiring campaign. In this connection it has issued a booklet entitled "The Edison House-wiring Plan." The book features this quotation of the inventor: "Electricity offers to every one an opportunity to have the home more cheerful, clean and sanitary." The method of wiring the house by standardized methods is a new one in Chattanooga and large results are looked for.

New Type of Rate Assumes Consumption of Four Kilowatt-Hours Per Room Per Month for Lighting.

To provide electricity for domestic uses, other than lighting, at low cost to the consumer, Commissioner L. H. Chapman, operating the municipal works in Kansas City, Kans., has inaugurated a new system of charges, effective April 1. It is based on an architectural plan, for which a survey of the city was made in March, and is accepted by the people as a two-cent rate for cooking, ironing, etc., or the equivalent of natural gas at 35 cents a thousand feet.

The plan works something like this: Assuming that four kilowatt-hours per room are necessary to light a residence per month, a charge of six cents a kilowatt-hour, according to the number of rooms, is made for lighting; all current in excess of that for lighting (supposedly used for cooking, ironing, etc., is then charged at two cents a kilowatt-hour.

For example, a consumer occupying a six-room house and using 100 kilowatt-hours monthly, will pay six cents a kilowatt-hour for the first 24 kilowatt-hours for lighting; while for the 76 kilowatt-hours in excess of that he will pay two cents per kilowatt-hour; thus making his monthly bill $1.44 for lighting and $1.52 for cooking, etc., or $2.96 for all energy used.

The former rate was six cents for lighting and three cents for other domestic uses. Two meters were used.

New Idea in Advertising Introduced by Milwaukee Company.

Charles Lamb, publicity director for the Milwaukee (Wis.) Electric Railway & Light Company, has taken upon his shoulders the great task of making all Milwaukee smile.

"Carman Smiles" is the newest brain child of Mr. Lamb, who supervises both the traction and central-station advertising for the Milwaukee utility.

"Smiling patrons mean thousands of dollars to a company every year," declared Mr. Lamb. "If I can get all our employees and all of our patrons smiling, profits will be increased considerably."

In big advertisements in the daily newspapers, in the street-car advertising cards and in "Of Public Interest," a little folder passed out on the streets, the face of "Carman Smiles" appears. In introducing "Carman" to the public Mr. Lamb wrote:

"Carman Smiles speeds over miles of track on every day, he ne'er reviles, but reconciles what people have to say. With cheerful grace and smiling face his patrons he beguiles; when joy's embrace angers efface, Carman Smiles, just smiles. He stands to serve, nor does he swerve from humor through the miles; he would preserve his pleasing verve, so smile with Carman Smiles."

Toledo Strives to Exceed Cleaner Sales Record.

The new-business department of the Toledo (O.) Railways & Light Company is breaking more records in its vacuum-cleaner campaign. Last year March sales of Hoover vacuum cleaners amounted to $15,500. This month A. K. Young, new-business manager, stated that this could be beaten. With the month of April only half over 170 machines had been sold with a total value of $10,500, so the chances are that the record of last year will be surpassed. An unusually energetic advertising campaign is being conducted, which includes letters to over 2,000 prospects, large displays in the newspapers and advertisements carried inside of the street cars.

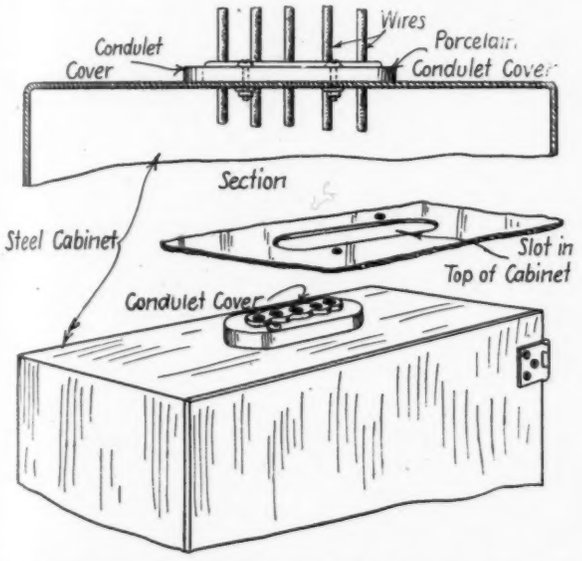
ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Using Condulet Cover for Bringing Wires Through Walls of Steel Cabinet.

By E. M. Raetz.

The wireman is often called upon to mount a three-pole motor switch in a steel cabinet. If it is desired to make a specially neat job, one can take a Condulet cover and lay out a slot just the size of the shouldered part of the porcelain and cut out the sheet metal so this part will just fit snugly. By using two bolts and washers as shown the cover will be held in place. Where there are six or more wires to be brought out, this makes a neater and cheaper job than the use of six bushings with all the drilling and



Simple Method for Bringing Wires Through Top or Sides of Steel Cabinets.

fitting incident to placing such a large number of bushings. Reference to the sketch shows the working of this scheme.

A Useful Little Tool for Handling Screws.

By M. A. Walker.

It is often necessary to place a screw or bolt into position in a very awkward place. Often the screw must be inserted in a location where space is too cramped for the hand, or too deep for the hand to reach. Perhaps, to make matters worse, the screw has to be inserted overhead. While there are many places where these conditions obtain perhaps they are particularly prone to occur in electrical work, and especially instrument repairing, in conduit installations and automatic devices on switchboards.

Where the screws are made of steel or iron, a screw driver which has been magnetized will usually hold the screw sufficiently rigid until it can be started into the thread. Unfortunately the screws are not always of magnetic material, and other means need be employed. A little tool which will be found extremely useful under these circumstances, or in place of the magnetized screw driver is shown herewith. It consists of a piece of steel about one-eighth inch in diameter and some six or more inches in length, according to the purpose for which it is to be used. One end is slotted down the center of the rod for a length

Handy Tool for Inserting Screws in Awkward Places.

of about one and one-half inches. The outside is then ground down to a taper and flattened.

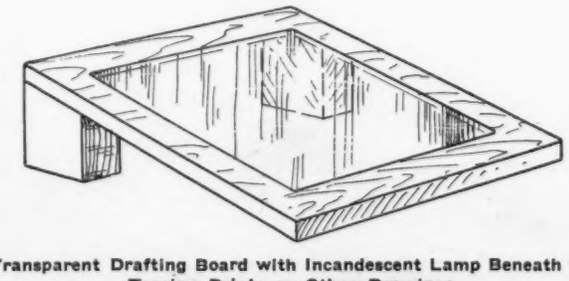
In using this tool the two ends, which have a spring effect due to the slot between them, are held between the finger and thumb, so as to come close together. The ends are then inserted into the slot in the head of the screw and the pressure between thumb and finger removed. The two ends then tend to open and hold the screw tightly, until it is put in place, when the ordinary screw driver may be used. The use of this tool often saves considerable time and exasperation, and may frequently prevent the loss of the only screw available at the time.

Transparent Drafting Board to Aid in Tracing Blue-Prints and Drawings.

By W. T. Slauson.

Frequently the engineer or estimator in an electrical contracting office finds it necessary to make tracings of architects' or other drawings in order to rearrange circuits or to obtain the main features of the plan involved without the superflous details. When the original is a blue-print this is tedious work, especially if the lines are faint. In some cases this has been done by placing the drawing and tracing against a window pane, but it is found to be a very awkward way in which to obtain results.

To overcome this difficulty a simple tracing board can be made, as illustrated. Taking an ordinary drawing board, a rectangular opening is cut out of the center, leaving a ledge on the side, to support a sheet of plate glass whose upper surface is flush with the board. Two blocks or struts are fastened to the board to give a comfortable working slope. An incandescent lamp placed under the glass and drawing brings out the lines of the lat-



Transparent Drafting Board with Incandescent Lamp Beneath for Tracing Prints or Other Drawings.

ter so that they may readily be seen, making the work of tracing easier. When it is desired to spread the light for the entire drawing, the under surface of the glass may be covered with sapolio or a similar substance.

Holyoke's Up-to-Date Fire-Alarm System

An Exceptionally Complete and Efficient System for Transmitting and Recording Fire Alarms in a Progressive New England City—General Description and Wiring

By GEORGE A. BRODER

EARLY this year the newly installed fire-alarm telegraph system at Holyoke, Mass., was put into service, taking the place of the old six-circuit automatic system. The new installation is the most modern and one of the largest central fire-alarm offices in the country. It embodies the latest and best features of automatic, semi-automatic and manual types of central-office fire-signal systems.

To keep pace with the growth of the fire department and insure the quickest possible location of and response to a fire, the signal boxes throughout the city were speeded up from two seconds to one second time between blows, thus saving one-half the time that it formerly took to receive one complete alarm, besides leaving the box circuits intact and the apparatus ready to respond to other alarms on the same or other circuits.

General Features of New System.

This is a two-speed system, providing fast time for incoming box and outgoing joker circuits and slow time for the outgoing gong circuits. To insure absolute reliability and guard against unforseen conditions, the outgoing fast-time signals may be transmitted by three independent pieces of apparatus and the slow time sent out from two different machines.

An operator is on constant duty to answer all fire and inter-station telephone calls and to transmit all fire-alarm signals when the system is being operated manually or semi-automatically.

Future growth is amply provided for by extra box, gong and joker circuits on the switchboards and electromechanical transmitting apparatus, which is built for 16 box, 6 gong and joker, and 2 local circuits, or five times as many as in the old system.

At present there are 8 box, 5 gong and joker circuits in service, operating on closed series circuits from independent storage batteries which furnish 0.1 ampere constant current, while the office transmitting, indicating and recording apparatus is of the open-circuit type supplied by 10 and 20-volt storage batteries.

Central-Office Equipment.

The fire-alarm office is on the fourth floor of the new $250,000 fireproof central fire station on Maple Street in the center of the city. All outside lines enter the basement in rubber-covered multiple-conductor lead-sheathed cables, containing No. 14 B. & S. gauge copper wire. These cables terminate on connecting strips on the rear of the protector switchboard.

From the terminal blocks the lines enter the 32-circuit protector or "detective" switchboard through loop pin switches shown at the top and also at the middle horizontal row in Fig. 3. They then pass downward through overload circuit-breakers, fuses, milliammeters, lightning arresters and combination pin switches having terminal plates for the outside, inside and battery lines. Any of these lines may be opened, grounded or short-circuited by various simple plugging combinations. In the center are arranged in order an overload alarm bell, a master time clock for the time and date stamps, a ground detector with its switch and two rotary ground-test switches by means of which each side of each of the 32 circuits can be tested for ground.

The inside office lines connecting to the pin switches are

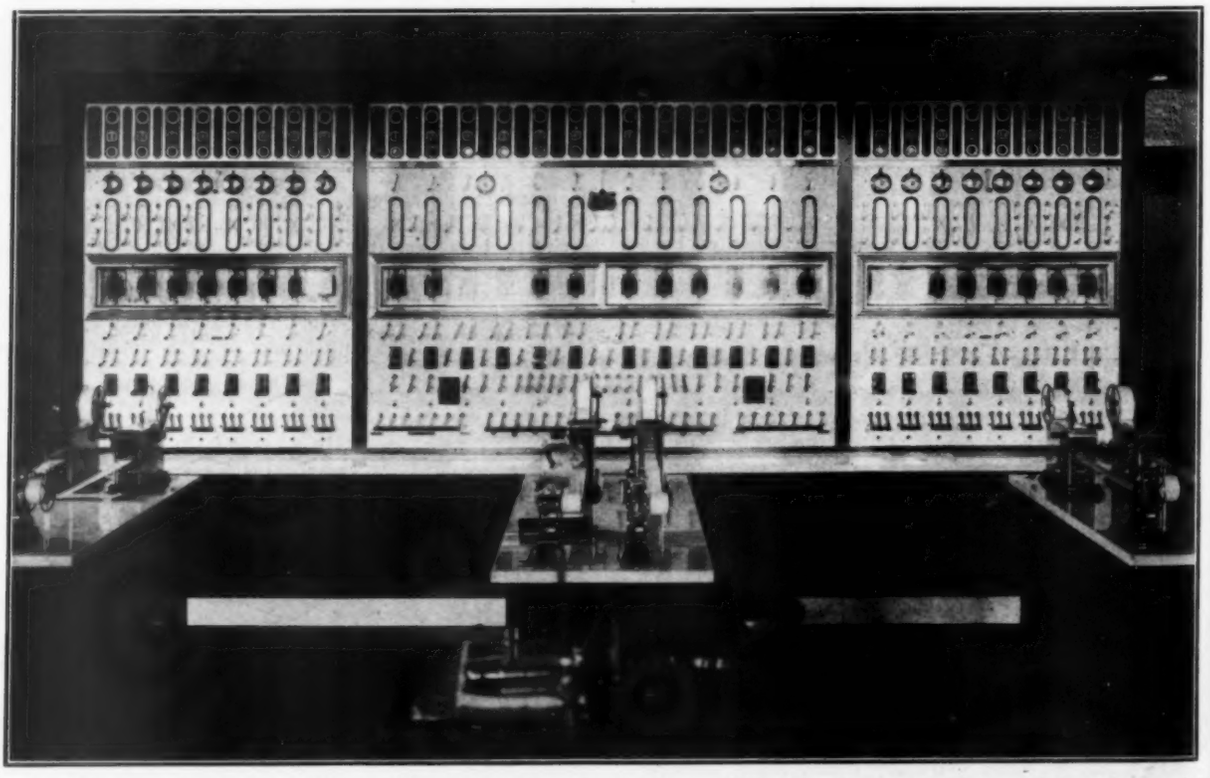


Fig. 1.—Main Operating Board at Holyoke Central Fire-Alarm Office, Showing 8 Box Circuits at Each End and 12 Combination Joker and Gong Circuits in Middle. Recording Registers Are on Pedestals in Front of Board.

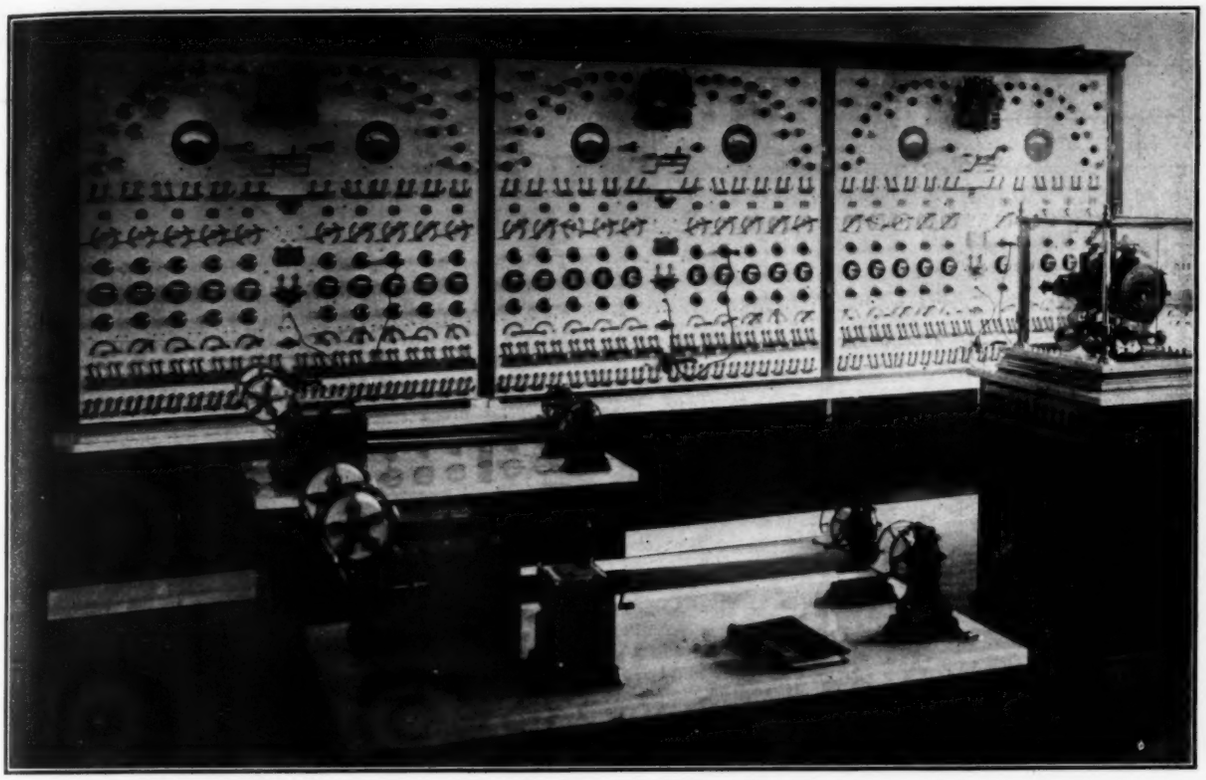


Fig. 2.—Thirty-Circuit Automatic Storage-Battery Controlling Switchboard; Box-Recording Registers in Front of Board and Manual Transmitter at Right.

run in three-inch rigid iron conduits laid in the cement floor and enter the bases of the operating, joker, gong and storage-battery switchboards and pedestals. The operating panels are in two sections and can be seen at each end in Fig. 1, while the 12-circuit joker and gong panel is between them.

Each box circuit passes through the line relay, which operates the multiple pen shearing registers, flashlight annunciator and superintendent's recording set, giving visual and audible signals and a permanent record of each alarm on a paper tape and printing the exact minute it is received.

For each box circuit there is a four-inch tap bell, telegraph key, instrument jack, and semi-automatic indicating repeater switch, which will connect any box circuit to the repeater, even if all the repeater switches are at their "off" positions.

The individual and ganged repeater-controlling switches are shown in the lower center of the combination switchboard and from here each circuit connects to the repeater magnets of the 16-circuit semi-automatic fast-time repeater (Fig. 4) and back to the pin switch and battery.

The joker and gong circuits are protected similarly to the box circuits and connect to joker and gong panels and through identical, visual, audible and recording apparatus to the ganged selective switches, whereby the fast time may be transmitted by any one of three separate pieces of mechanism, consisting of the automatic repeater, manual transmitter, and joker transmitter and the slow time by the manual transmitter and automatic transformer.

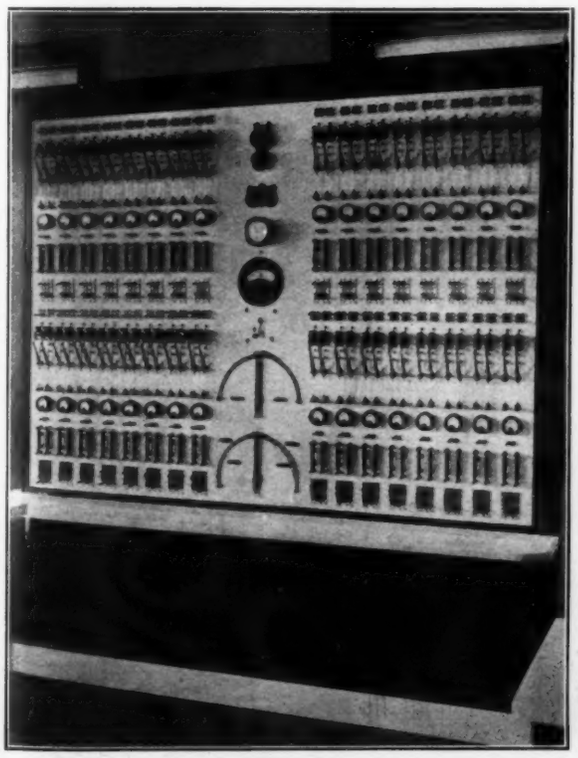


Fig. 3.—Protector and Test Board for Lines Entering Office.

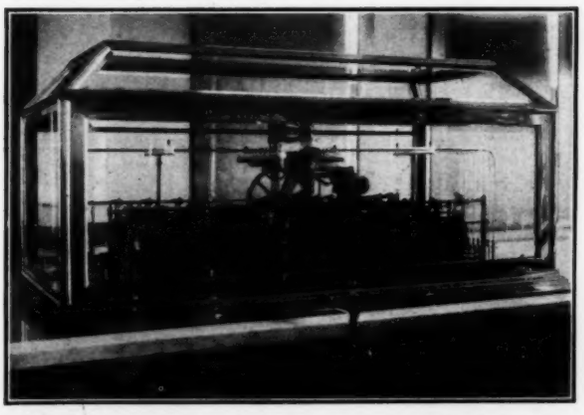


Fig. 4.—Sixteen-Circuit Automatic Fast-Time Repeater.

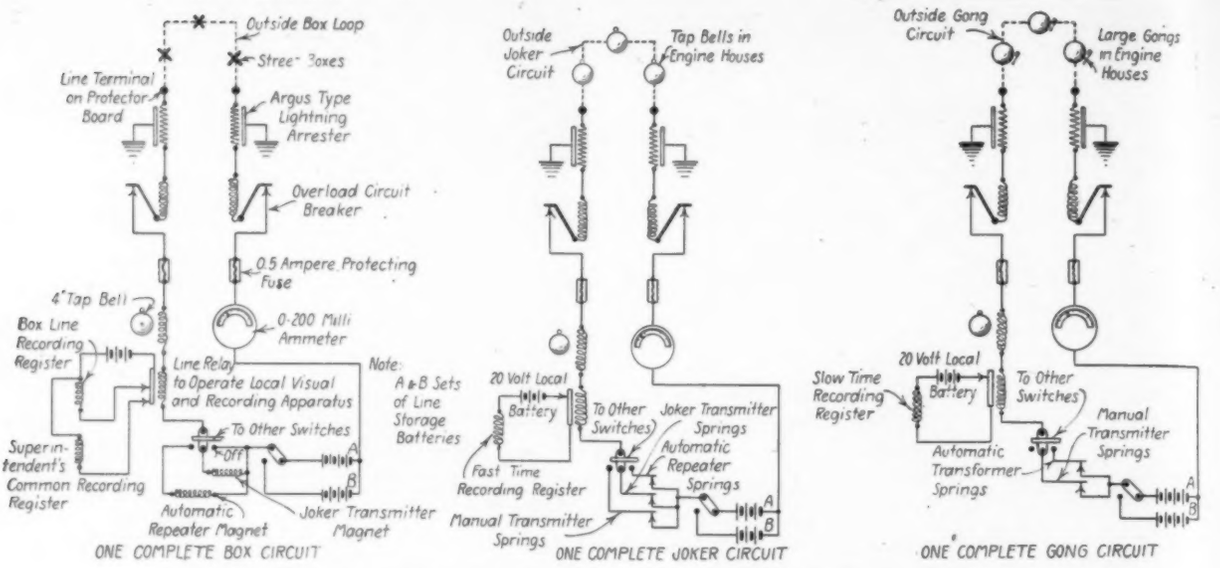


Fig. 5.—Wiring Diagram of Box, Fast-Time and Slow-Time Signaling Circuits.

When operating the system purely automatically, all box circuits are connected to the repeator magnets although the repeater switches, and an incoming alarm on any box circuit will function the repeater to transmit or duplicate the alarm as received over all joker circuits simultaneously, and through the transformer controlling contact-making springs, release the transformer (Fig. 6) which is an electromechanical machine to change from the fast box time to the slow gong time. After one complete round of an alarm is received from the street box that is pulled, the transformer automatically commences to transmit the signal over all gong circuits at a one-half speed reduction or one second fast time to two seconds slow time.

When operating the office semi-automatically the operator receives the alarm from the street box by the visual, audible and recording apparatus and after the first complete round is received throws the corresponding semi-automatic box-circuit switch "on," connecting it to the joker transmitter-controlling magnet and the remaining three rounds are automatically transmitted over the joker and gong circuits by the transmitter and transformer, respectively, just as is the case when operating on the complete automatic plan.

To operate the system manually, an operator is required to be on constant duty to receive and transmit all alarms. An incoming signal on any box circuit is received by the operator and after the first complete round is received he steps to the one-dial four-number manual transmitter (Fig. 7) and sets the street-box number up in duplicate and releases the mechanism, first to transmit at fast time over the joker circuits and then at slow time over the gong circuits; or the slow time may be sent automatically by the transformer through controlling contact springs on the manual transmitter similar to those on the repeater.

All the transmitting devices are electromechanical in operation, being weight-driven and electrically released, insuring reliable and ample driving power and uniform tension throughout their operation. They are mounted in glass cases on mahogany and art metal pedestals with white Italian marble trimmings.

The recording apparatus includes four four-circuit box and

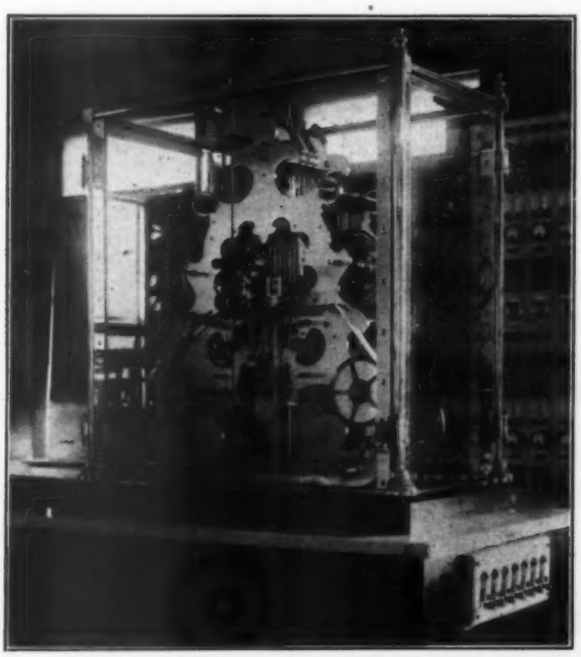


Fig. 6.—Automatic Fast and Slow-Time Transformer.

Fig. 7.—One-Dial Four-Number Manual Transmitter.

two six-circuit joker and gong multiple-circuit arrow-pen shearing-type registers, with an automatic time and date stamp on the fast-time outgoing circuits. These also are mounted on artistic pedestals.

The superintendent's recording set consists of a punching register and time stamp operated by the box-line relays and permanently records and dates the reception of all alarms.

In Fig. 5 are shown schematic wiring diagrams of the principal circuits in the office.

Storage-Battery Equipment.

The storage-battery controlling switchboard consists of three ten-circuit panels shown in Fig. 2. The board is of the automatic type, which automatically protects the batteries against abnormal conditions, such as overload, underload and reverse-charging polarity, and discontinues the charge after any set interval has elasped.

Protecting fuses and line rheostats are provided on the working circuits and voltmeters and ammeters for testing the charging or working battery circuits.

Two motor-generator sets furnish 220 and 500 volts direct current for the charging of the storage batteries. The battery switches give any desired combination of lamp and battery groupings for the most economical charging.

White Italian marble is used for all switchboards with brush-brass-finished mountings and set in mahogany art-metal steel frames trimmed with marble shelves, giving a pleasing contrasting effect. All switchboards are wired with No. 14 and No. 16 slow-burning wire.

The battery room at the rear of the central office contains three rows of five shelves, each of insulated metal battery racks with capacity for 500 storage cells of the couple type. These are connected on the A and B banks. The couples are mounted in glass jars on glass rods and porcelain insulators. Each set of batteries on each circuit is protected by three-ampere cartridge fuses. The batteries are connected to the storage-battery switchboard through wires concealed in the ducts, which enter floor boxes under each post. The wires enter the pipe posts from below and connect to the fuse blocks.

A private-branch-exchange telephone switchboard with 10 auxiliary lines to official and engine-house instruments is used for fire-department calls. It is also connected with the New England Telephone Company's system by three trunk lines for public calls.

The complete system was installed by the Gamewell Fire Alarm Telegraph Company, of New York, under the direction of A. D. Wheeler, its New England agent. The installation work was done by E. P. Cochrane and G. A. Broder, construction engineers for the Gamewell Company.

No expense nor trouble was spared by the Fire Commissioners of Holyoke to secure for the city an up-to-date system so that Fire Chief George Hill and Superintendent of Fire Alarm Thomas Monaghan may give the city the best possible fire protection.

Leaving Air Space in Mounting Rheostats.

By M. J. Moriarty.

Whenever I mount a rheostat on a slate slab, an asbestos board, or on a wood mounting, I always provide for a ventilating air space of one inch back of the rheostat. To do this I mount the rheostat on four split porcelain knob bases, using lag screws or bolts long enough to go through the rheostat base and the split knobs and into or through the supporting material. By using a little black paint of the dull black type the knobs can be painted to match the slate or rheostat finish.

License Fee Discontinued at Owensboro.

A license fee of $25 formerly required from electrical contractors by the city of Owensboro, Ky., has been discontinued. Bonds will be required, providing that the contractors must make reports of all connections made by them to the distribution system of the municipal plant.

Proceedings of Electrical Contractors' Association of Illinois.

The Electrical Contractors' Association of the State of Illinois has issued in pamphlet form a condensed summary of the proceedings of its midwinter meeting held in Chicago on January 16 and 17. It gives a report on all the action taken at the several sessions and includes abstracts of the principal addresses presented, which were all on timely subjects. Copies of the pamphlet should prove of great interest to all electrical contractors in the state and convince them of the important work of the association and of the advantages of active membership.

The annual meeting will be held next June in Peoria. L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill., is secretary-treasurer of the organization.

Los Angeles Adopts New License Ordinance for Electrical Contractors.

The City Council of Los Angeles, Cal., has adopted an ordinance charging a $50 fee for electrical contractors' licenses and making it a misdemeanor for anyone to do electrical work of any kind without first securing a license. The license is renewable at the end of a year without the payment of an additional fee if the law has been complied with.

The city of Los Angeles has also passed an ordinance that took effect on April 1, which places the city on a conduit and metal-molding basis.

Among the Contractors.

The Morrison Electric Company, 109 Park Street, Portland, Ore., has the contract for complete electrical installation in the plant of the Columbia Shipbuilding Corporation, to cost $40,000.

The Golden State Electrical Company, Los Angeles, Cal., has secured the contract to do the electrical work on a new building being erected at Seventh and Olive Streets on its bid of $10,000.

A new electrical firm to be known as Troop & Cooley has opened a store in New Britain, Conn. Fred Hitchcock, who is now with the United Electric Light & Water Company in the contract department, will manage the store.

The Thompson-Starrett Company, New York, N. Y., has been awarded the contract for electrical equipment in the new Public Library to be erected by the city of Philadelphia, Pa., on the Parkway, at a cost of $79,000. The entire structure will cost $2,664,000.

L. L. Peake and C. J. Vander Schoor, for many years in the employ of the Roseberry-Henry Electric Company, Grand Rapids, Mich., have formed a partnership under the name of Peake & Vander Schoor Electric Company and will do electrical contracting in Grand Rapids.

W. J. Squire, of Kansas City, Mo., has received the contract for the engineering and construction work on extensive improvements at Park College, Parkville, Mo., including rearranging and rebuilding of the light, heat and sewer systems, and certain buildings, the contract totaling about $100,000. Two generators and other equipment will be added to the lighting plant.

Under the firm name of Wauchope & Gale, J. M. Wauchope, formerly with the Westinghouse company at Salt Lake City, and R. E. and R. L. Gale, recently employed by the Judge Mining & Smelting Company, of Salt Lake City, have entered the engineering field at Twin Falls, Idaho. The new concern is specializing in motor-generator repair work, central-station and power-plant erection, irrigation pumping plants, etc.

QUESTIONS-ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions may relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers accepted and published.

Questions.

No. 384.—Design for Small Transformer.—Will some reader kindly give me the size and amount of wire to use, size of core, etc., to make a small dry-core transformer with one-to-one ratio. The secondary voltage should be 5 volts and the secondary current should be 6.6 amperes. I prefer a round core, but square one could be used; it should be as small as possible. As I sent this question in originally it implied that the ratio of transformation was 2,200 volts to 5 volts. This is not what I intended, however. The transformer is to be used with a lamp of 30 to 35 watts.—W. I. C., Modesto, Cal.

No. 388.—Induction Coil for Wireless Set.—I would like to secure data for building a four-inch induction coil to be used on a small wireless set. It is to operate on 110 volts direct current, but if the primary will not stand that voltage, I can probably reduce the voltage to the required amount. I would like to find out the following: Length of primary and seconary coils; number of turns on each; number of layers on each; size of wire for each coil, and amount of wire in pounds for each; also the diameter of core. Can single cotton-covered wire be used on the secondary?—R. C. S., Pontiac, Ill.

No. 390.—Good Tool Chest for Electrician.—Will some electrician who has a tool chest that he considers entirely satisfactory please give a description of it, or state where such an outfit may be bought. I should also like to know what is considered a good list of tools for an all-around electrician in an industrial plant where he has to do a "little bit of everything."—A. S. N., Plymouth, Mass.

No. 391.—Test for Live Cables.—Will some one inform me of a method by which I can tell when a high-voltage (4,600 or 2,300-volt) underground line is closed at the sending end only. It is necessary to make repairs to these lines occasionally and the method must be of such a nature as to be used in a manhole. Charging current only will be flowing on the line so that the same test as when the cable is closed at both ends fails here. There are several other similar cables in parallel duct runs and all carrying load.—L. F. C., Detroit, Mich.

No. 392.—Depreciation Charge and Cost of Reinstallation.—When setting aside an annual depreciation charge for replacing worn-out, obsolete or other unsatisfactory utility equipment, is it customary to provide in this charge for the cost of installing the new apparatus or other equipment, or merely for the cost of purchasing new apparatus for that thrown out? In the latter case, to what account should be charged the cost of setting and connecting the apparatus in place?—B. E. H., Maywood, Ill.

Answers.

No. 381.—Ventilation of Flush Ceiling Fixtures.—Is it reasonable to insist on special ventilation upward in the case of a 100-watt fixture depressed flush in the ceiling? A series of these fixtures with glass bottoms is set into the ceiling under a balcony of a theater where there is limited headroom. There is a small ventilating clearance between the sides of the fixture and the frame for the glass bottom, but the inspector insists that a ventilating duct be run upward.—V. S. C., Buffalo, N. Y.

Answer A.—There is no real fire risk to any surrounding elements from the heat arising from the use of a 100-watt incandescent lamp in connection with an inclosed flush ceiling fixture as described using porcelain fittings, asbestos-covered wires and circuit properly fused. Before the introduction of the porcelain sockets and fittings, asbestos-covered wires, etc., there was local trouble with inclosed fixtures of many styles, the heat gradually charring the composition sockets and the insulation of the wires. This often caused "shorts" and grounds which caused the fuses to blow on the respective circuits, but at that one rarely ever heard of any real damage directly traced to this trouble alone. I would not consider it reasonable to insist on special ventilation. But this is one of the cases where it is always policy to arrange to have everything in accordance with the requirements of the inspectors, provided the point has been taken up as to the necessity in regard to life or fire risk as set forth in the rules of the fire underwriters and city ordinances relative to electrical work. It is the duty of these inspectors to follow up and see that these rules and requirements are strictly adhered to; if they do not do so I have found in my experience of 20 years as a contractor that the rules are abused and evaded where possible on many occasions by those installing electric lighting and power apparatus. I always endeavor to agree with the inspector, regardless of whether my ideas were at first in accordance with his, on any work to which there was an apparent objection, avoiding where and when possible any arguments that might lead to a misunderstanding or an unreasonable demand on his part. By following this plan when an occasion arose for favor, such as the above, I have been granted concessions. Another most important point, if one wishes to work in harmony with the inspectors and not be held up on every little detail, is this: do not attempt to go contrary to their orders or bring other sources to bear over their heads. Consult them first. By such actions your doom is sealed and in future they will invariably hold you up on every little detail strictly to the letter, which means labor and expense for changes not absolutely required and which would be allowed and passed under ordinary conditions. The above relative to inspection are the usual results, with few exceptions, that follow any forcible or "higher up" tactics to gain the contractor's point against the orders or wishes of any supervisor or inspector of electrical work employed by the insurance companies or the city where there are city ordinances covering electrical work.—F. F. H., Milwaukee, Wis.

Answer B.—I believe that the inspector is right in demanding ventilation in or near the top of the fixture. It would, of course, be better for the man submitting the question to make a sketch with dimensions. The ventilation may be provided by means of a ventilating housing either having chimney with cap or holes on the side to let the heated air pass between the floor and ceiling. A short time ago I examined the fixtures installed under the balcony of a local theater. The so-called tubs are approximately 18 by 24 by 12 inches deep and have only four receptacles with a 25-watt lamp in each receptacle; three are on the house circuit which only burn between shows and one on the emergency circuit which burns constantly while the show is on. No appreciable heat was detected on top of the fixture. These tubs are fitted in sometimes with an I-beam half way through or some other iron structure between the floors and there are nearly always some openings where the tubs are fitted around these obstacles.—B. B., Milwaukee, Wis.

No. 385.—Peculiar Motor Trouble.—We have an alternating current motor which is causing some trouble that we cannot locate. The motor, which is used in a jeweler's shop to drive a lathe and polisher, is a one-eighth-horsepower Fidelity motor operating on a 110-volt circuit. After the motor has been operating for about thirty minutes on three-quarters to full load, the lamps in the shop lose about half their candlepower and a little later burn out. The building is wired correctly and the motor seems to be in good condition—it is a new motor. The motor is of the single-phase commutator type on which the speed adjustment is secured by shifting the position of the brushes. The meter used on this service is a five-ampere Fort Wayne. The lamps in the shop do not require more than one ampere when they are all burning. Any information in regard to the cause and remedy of this trouble will be appreciated.—L. H., Jetmore, Kans.

From the account given it is evident to me that the motor is all right and that the lamps are to blame, because if the motor runs well at starting and continues to run so even after the lamps burn out, this is clear evidence that the motor is

O. K. Otherwise the fuses would blow or should blow if they were of proper size. A motor running on the same circuit would not interfere with the lights unless it blew the fuses and put the lights out by opening the circuit. It is usually best not to run motor and lights on the same circuit on account of voltage disturbance when starting or stopping the motor. If they are on the same circuit in this particular case it may be well to put them on separate circuits. Then if the motor gives trouble it will clearly give indication of it by blowing fuses or showing some other symptom, such as sparking, flashing, etc. After putting them on separate circuits, if the motor runs well and the lamps still give trouble, I would advise the querist to change his brand of lamps and purchase them from a reliable manufacturer or jobber. If even this fails to remedy the trouble, it will be necessary to call in a competent electrician to locate and remove the trouble.—W. T. E., Ansonia, Conn.

No. 387.—Removing Oil Stain from Marble.—I would like to ask whether any one can tell me how to clean satisfactorily a marble switchboard that has become somewhat discolored from oil.—A. R. S., East Lansing, Mich.

Answer A.—A very satisfactory way to remove oil stains from marble is to saturate a quantity of Fuller's earth with a solution composed of soap liniment, ammonia and water, in equal parts. This paste is then applied to the oily surface of the switchboard or marble for several hours. The mass should best be applied firmly and with force, as by an electric iron, and best results follow if the mass is kept warm. The Fuller's earth under the influence of warmth will become dry and the solution of ammonia, water and soap liniment should be replenished as occasion demands. After a few hours' application the oil stain will usually be found to have been removed. Another stain may reappear a few days later, however, and is due to oil from the interior of the marble coming out to the surface. A further application of the above treatment will remove it. Two such applications usually suffice, though several may be necessary. Another way to remove oil is to saturate common clay with benzine and apply to the stain. Benzine is inflammable and must be handled carefully therefore. Grease long present in marble ruins the polish, hence after its removal it is often desirable to obtain luster and polish again. A weak solution of oxalic acid rubbed by a cloth or sponge and immediately washed off with water will go a long way toward removing stains and dirt. With the stains removed, polish may be obtained by rubbing the marble with white wax and turpentine, in a solution of about 1 in 10, with a soft cloth. A mixture of finely powdered pumice stone and vinegar also makes a good wash that tends to remove dirt and stains.—K. R., Chicago, Ill.

Answer B.—In removing grease stains from marble I have found a paste made of chalk and potash or soda very efficient. Apply a thin layer of the paste on the marble and allow it to remain for some time and then wash it off. The length of application depends on the age of the stain, some requiring several applications. The alkali forms a soap with the grease which can easily be washed off. Do not leave acid materials in contact with marble as the latter is easily dissolved in them. —R. R. K., Madison, Wis.

No. 389.—Design for Lifting Magnet.—I wish to construct a magnet to pick up sheets of steel 4 feet by 4 feet square. The sheets weigh about 300 pounds and are to be raised through a distance of 0.125 inch. The core of the magnet is to be made of a good grade of sheet steel, such as is used in transformers. The magnet is to be operated on three-phase, 25-cycle, 220-volt current. Please give formulas and show with same how the number of turns to be placed upon the magnet core is predetermined. The magnet is to operate about 10 hours per day.—L. H. W., Cincinnati, O.

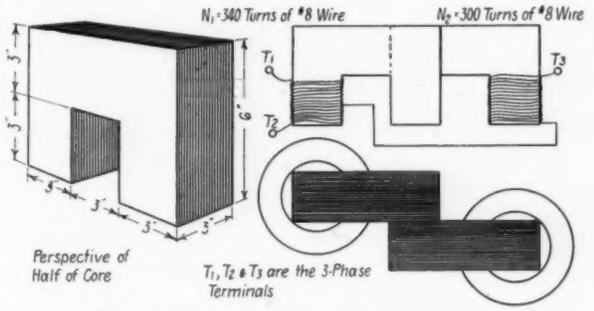
The general formula for this type of magnet is

$$\text{Pull}=\beta^2 A/8\pi$$

where β is the magnetization in lines per unit area, and A is the area. Rearranging this formula and converting it to practical units, we have

$$\text{Area}=\frac{867{,}500\times\text{Pull (in pounds)}\times\text{Factor of safety}}{(\text{Maximum density in gauss})^2}$$

Using in this case a factor of safety of 3⅓ and a maximum density of 10,000 gausses per square centimeter, we find on substitution an area of 8.675 square inches. Let us take, there-



No. 389.—Design for Three-Phase Lifting Magnet.

fore, an area of three by three inches, or nine square inches. The core may be arranged as shown with two adjoining inverted U-shaped sections and two coils on the further legs connected like a phasing transformer. The number of turns on each coil is found from the following formula:

$$N=E\times 10^8/(4.44\times f\times\beta\times A)$$

where N is the number of turns of wire, E is the voltage, f the frequency in cycles per second, β the maximum density in gausses per square centimeter, and A the area in square centimeters. On substituting, we find for the first coil

$$N_1=(220\times 10^8)\div(4.44\times 25\times 10{,}000\times 9\times 6.45)=341$$

and $N_2=86.6\times N_1=295$.

We will take as practical values of N_1 340 turns, and N_2 300 turns. At 10,000 gausses per square centimeter, the current required to overcome the iron losses is negligible compared to the exciting current. With two one-eighth-inch air gaps, the exciting current to produce 10,000 gausses in the iron is negligible compared with that required to produce 10,000 gausses in the air. The ampere-turns for two one-eighth-inch air gaps and 10,000 gausses equal $0.313\times 6.45\times 10{,}000\times 0.25=5{,}050$.

The currents in the two coils are found as follows:

$$I_1=5{,}050\div(\sqrt{2}\times 340)=10.4 \text{ amperes.}$$

$$I_2=5{,}050\div(\sqrt{2}\times 300)=12.1 \text{ amperes.}$$

In each case No. 8 B. & S. gauge will prove satisfactory.—L. A. D., Annapolis, Md.

A Suggestion for Selling Electric Irons.

A good tip for electric iron salesmen is contained in the experience of the superintendent of the hospital laundry in the city hospital at Louisville, Ky. In this laundry, in which four women are employed nine hours a day at hand ironing, electric irons are used exclusively, fed by the isolated plant at the hospital. Albert Babby, manager of the laundry, however, found that the ironers lost much time by reason of the fact that their irons, being in constant use on the damp garments lost their heat. He solved the problem by attaching the feeder cords of two irons to each plug and now each laundress has two irons at hand. She uses one until the "edge" is taken off its heat and then sets it aside to take up the other which has been accumulating heat all the time. A fifth board is maintained, with its two irons, for use in emergencies, and the four laundresses by the use of this equipment are able to make much more progress in their work. They are employed on a flat rate but much prefer to use a satisfactorily heated iron to waiting while a cooling one "catches up." A plan of this kind ought to work to good advantage wherever piece service is more important than cost, or in laundries in which piece work is the basis, or even in private laundries where the mistress is fastidious about the character of the laundry work.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Inclosing Cases for Time-Limit Protective Plugs.

The time-limit protective plug is a comparatively new device and is becoming well known through its use in the General Electric Company's motor-starting switch CR-1038 which includes two of these plugs.

There has been a demand for these protective plugs to be used in connection with drum type or other small motor-starting switches, and to meet this demand the company is now prepared to furnish two protective plugs in a sheet-

Inclosing Case for Protective Plugs.

metal case, as shown in the accompanying illustration. The case has a hinged cover and is provided with a hasp so that it can be locked closed. One-inch knockout holes for conduit wiring have been provided. The line from the starting switch to the motor can be broken at any point and protective plugs inserted. The plugs can be furnished for use with any alternating-current motor up to and including three horsepower on 110, 440 and 550 volts and five horsepower on 220 volts.

Spectrolite Lamp Designed for Color-Matching.

The St. Louis Brass Manufacturing Company, St. Louis, Mo., is producing a color-matching unit which is to be known as the Spectrolite, and for which many novel features are claimed. The form of the unit which promises to be most popular is the portable type illustrated.

The color-matching light is derived from a standard 60-watt Mazda lamp, the correction being accomplished by means of strips of glass, the color of which is so adjusted that by selective absorption of the rays of light from the lamp, there is emitted only that portion of the light which does not distort even the most delicate shades.

The selective absorption of light is claimed to be accomplished by contact of the light rays with the glass, rather than by passing through the glass as in other color-matching units, thus providing what is believed to be a more efficient unit. The arrangement of the glass strips is unique. They are disposed at a fixed angle to a line passing through the axis of the lamp and at a uniform radial distance in such manner that the emitted light must in all cases come in contact with one strip of glass from which it is reflected to the working plane.

Spectrolite Portable Lamp.

New Pittsburgh Vacuum Cleaner.

A new electric vacuum cleaner, known as the "Pittsburgh F. B.," has been added to the line manufactured by the Pittsburgh Electric Specialties Company, Pittsburgh, Pa. Like the "Pittsburgh F. A.," which has proved one of the most popular cleaners on the market, this new cleaner has a fourteen-inch nozzle and revolving brush for taking up ravelings, lint, etc. The motor is of the universal type, a feature that makes the housekeeper who moves frequently more willing to invest in a good cleaner. The cord is imbedded in the handle so as to be out of the operator's way at all times. The current is turned on and off by a Cutler-Hammer push-button switch located in the handle. The case is made of aluminum.

Pittsburgh F. B. Cleaner.

Universal Drafting Board.

Engineers, architects and draftsmen have long been dissatisfied with their most essential tool—the drafting board. They claim that the present horizontal board is inconvenient, and that the upright board, though more practical and more hygienic than the horizontal, is unwieldly and undeveloped. These men are looking for a board which will give more accurate and more efficient results, and will place less of a tax upon the time and health of the man.

A board is now being placed on the market by the Improved Drafting Board Company, Nashua, N. H., which aims to give just that kind of service. This "Universal" drafting board is designed to suit the tastes and requirements of all draftsmen, whether users of the horizontal or upright method of drawing, since this board has the unique possibility of being used in a horizontal or an upright position with equal effectiveness. In each position, it is said to eliminate the common faults of older boards of the corresponding type, and introduces new and important conveniences.

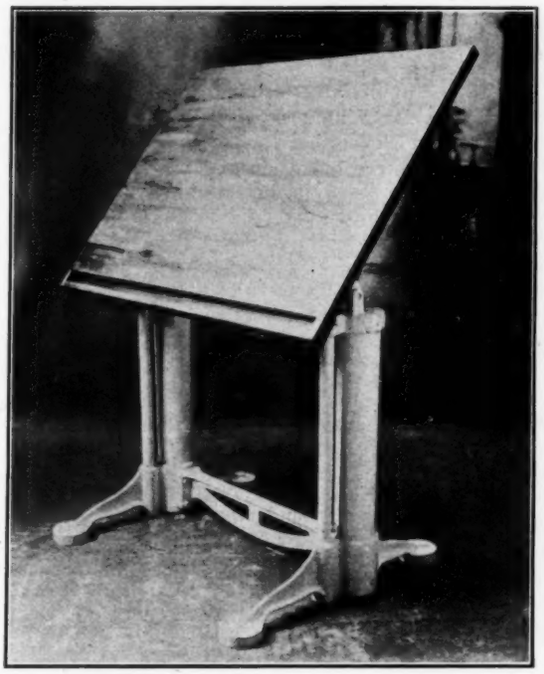
The Universal drafting board can be readily converted from any other of its positions to probably the most satisfactory horizontal board ever produced. In this position, the Universal board presents three distinct advantages. First, when used as a horizontal board, it is generally inclined to a few degrees from the true horizontal; but the angle of inclination can be quickly enlarged or diminished whenever desired. Second, the board can be used by short men and tall men, either seated or standing, since the height can be easily varied to suit all sizes and postures. Third, when set at the required angle and height, the Universal drafting board is absolutely stationary.

This board as an upright board will interest those who are finding in this position of the drafting board a way to more efficient and more hygienic drawing. Owing to the recent introduction of this process of drawing in America, upright boards, made here, are still in an awkward and undeveloped condition. The Universal drafting board is designed to overcome this difficulty. As an upright board, it is generally inclined to a few degrees from the vertical, but this inclination can be made more or less, as the draftsman desires. But the singular and important convenience of the Universal board in this position lies in the fact that the draftsman can raise or lower the board by a slight pressure of the hand.

Universal Drafting Board in Elevated and Oblique Position.

The horizontal and upright positions of the Universal drafting board, described above, represent the most common types of drafting boards on the market. But this new board can be converted into other positions too numerous to mention.

The main purpose of the Universal drafting board—good service—is carried out as well by some of its minor details as by its more prominent features. An automatic parallel rule, capable of being set at an angle to the horizontal, if necessary, and so attached to the board that there is no interference with the length of drawings, may or may not be furnished with the board.



Another View of Universal Board Lowered and More Vertical.

The lower part of the frame of the Universal drafting board is designed so as to form a footrest, a much appreciated arrangement for the comfort of the man who sits at his work. Wood, felt-covered blocks are provided beneath the feet, intended to prevent the scratching of floors.

Though possessing these numerous possibilities, the Universal drafting board has a peculiarly plain, handsome, and sturdy appearance. The concealment of the balancing arrangement, and the neat angle-adjusting device give an impression of the utmost simplicity. The material of the frame is metal, which assures strength and durability; this is white-enameled and finished with nickel-plated fixtures. The board proper is made of carefully selected narrow strips of the best soft Michigan kiln-dried pine.

Tungsten and Molybdenum Available in Form for Heating Elements and Other Resistance Purposes.

Among the properties possessed by the metals tungsten and molybdenum are high electrical resistance and ability to withstand high temperatures without injury. The developments in the production of these metals have now so far advanced that they are available in the form of ribbons, sheets and plates, thus making them adaptable for use as heating elements, resistors, contact points, and other electrical purposes. The Independent Lamp & Wire Company, 1737 Broadway, New York City, is placing on the market both these metals in the forms mentioned. The ribbon can be obtained in widths of 0.25 inch and in lengths up to several yards.

Two New Burke Lightning Arresters.

Two new lightning arresters have recently been placed on the market by the Railway & Industrial Engineering Company, Pittsburgh, Pa. Both are of the Burke series horn-gap type, using the triangular choke coil. They are especially adapted for use on the larger transmission systems of heavy capacity that have been developed so rapidly in recent years.

The arrester shown in Fig. 1 is similar to one of the arresters built by this company for a number of years. The change which has been made and resulted in improved operation and reliability of the arrester, principally in its ability to relieve and discharge heavy surges repeatedly without deterioration, is the use of a Koppat resistance of different characteristics than formerly used and the capacity or cubic volume of the resistance has also been increased over 300 per cent.

This resistance is shunted by an auxiliary horn gap connected direct to ground. In case of a discharge across this auxiliary gap the arc formed in it breaks almost instantly, thus inserting the resistance in the ground circuit in series with the power arc, which is broken in the main horn gap.

The arrester that is pictured in Fig. 2 is intended for use on transmission systems where very-high-capacity surges are experienced. This arrester is similar to the one described above, except that a reactance coil is connected in series with the high-capacity Koppat resistance in the ground circuit.

An auxiliary gap shunts both the reactance coil and the resistance, thus giving a straight path to ground for a surge of such capacity that cannot be discharged quickly enough through the reactance coil and resistance. The reactance coil aids in limiting the rush of power to ground or between phases in case two or more arresters discharge at the same time, and also relieves the resistance of the heavy strains by smoothing out the surges before it reaches the resistance.

Any abnormal rise in voltage is instantly relieved from the line and surges of even the highest capacity are instantly and effectively relieved from the line without causing any noticeable distrubance on the system.

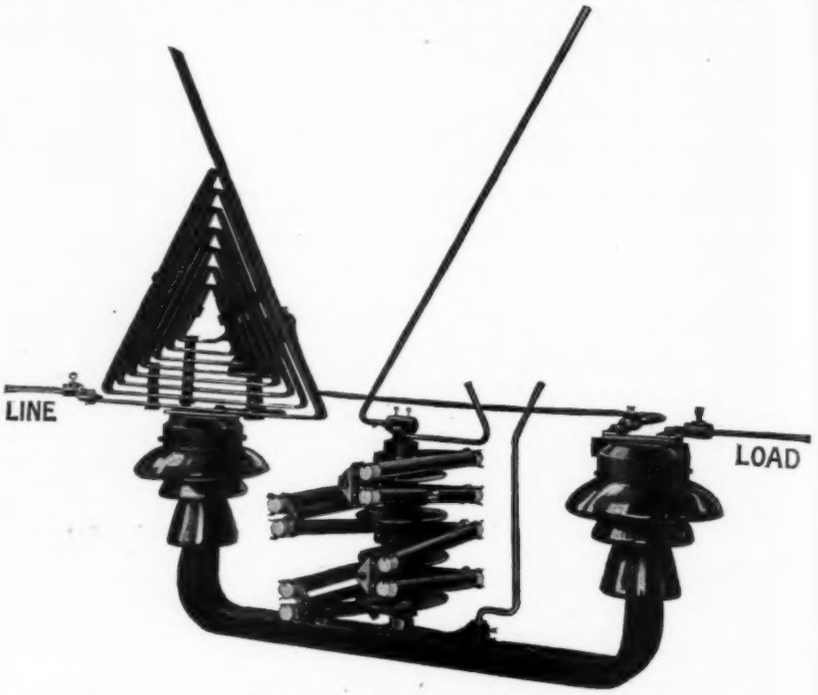


Fig. 1.—Improved Burke Horn-Gap Arrester With Koppat Resistance.

Fig. 2.—Lightning Arrester With Reactance and Resistance in Ground Circuit.

Doll Electrova Player Piano.

The player piano marketed under this name may be played by hand, operated by treadle, or electrically operated. When operated electrically, a small Westinghouse motor is employed, belted to a wheel controlling the air motor. When used as a player piano, only three levers and three buttons on the front rail need be manipulated, eliminating the possibility of confusion which would result were a multitude of expression stops employed. The piano is made by Jacob Doll & Sons, Incorporated, 98-116 Southern Boulevard, New York City.

The mechanism is very simple and is easily accessible for purposes of adjustment, substitution or repairs. The entire action of the piano may be removed, affording unhindered approach to the piano section for regulation and tuning. The air motors are of ample capacity, are readily controlled, and work steadily and noiselessly.

The collapsing of the air motors under extreme or irregular pressure, which in the early stages of treadle operation gave serious concern to many piano makers, has been eliminated, insuring an even, well-balanced wind supply, no matter what the force or character of its application. The motive power is at all times within the absolute and minute control of the operator, so that in conjunction with the automatic expression stops, pedal and tempo levers, all at instant command, any musical composition, even the most intricate, may be rendered perfectly correct in movement and accentuation.

ACTIVITIES IN THE TRADE

Beardslee Chandelier Manufacturing Company, Chicago, Ill., has issued several bulletins descriptive of its "Denzar" electric-lighting fixtures.

The Domestic Tungsten Lamp Company, 275 Bergenline Avenue, West New York, N. J., has purchased property on Tenth Street for plant extensions.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has insured its entire working force of about 320 in the Travelers Insurance Company of Hartford, in sums from $200 to $1,000, according to their wages. The policies contain a total disability clause which provides that employees thus injured will receive the amount of their insurance in installments for a stated period.

Holophane Glass Company, 340 Madison Avenue, New York City, is sending out to the trade announcement of an introductory offer being made on the smallest size of the new Holophane reflector-refractor units (No. 2110). The company offers five of these units free with every order of 15, with regular discounts on the standard package of 20 units. The offer expires April 20, 1917.

Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill., has prepared an attractive booklet entitled "Care and Operation of a Hughes Electric Range," which by illustrations and text describes in a very efficient manner the different points in connection with the operation of an electric range. The booklet is intended for distribution to owners of ranges and includes blank tables for the keeping of records on the cooking of various foods.

Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill., is sending to the trade an advertising folder in connection with its spring campaign on the Benjamin "92" two-way plug. Besides the usual line of attractive folders, window-display material, wall-hangers, etc., the company is securing the support of central stations, dealers and contractors through the use of newspaper electrotypes, lantern slides and special bulletins prepared by the company. An elaborate counter stand is being prepared which will be ready for distribution to the trade in a few weeks.

Mechanical Products Company, 537 South Dearborn Street, Chicago, Ill., has placed on the market an automatic motor-operated door opener and closer for garages, which operates by means of a drum and steel cable and controlled by push-button stations and limit switches to a relay which controls the motor and the direction of its rotation. The device has been approved by the Underwriters' Laboratories. Sales are in the hands of Richard-Wilcox Manufacturing Company, Aurora, Ill., which will devote much of its publicity work to interesting electrical contractors, who are necessary for the installation of the device and which will be sold direct to them on liberal terms.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog 1-A, on lightning arresters; catalog 2-B, on switchboard accessories; catalog 5-B, on railway accessories; leaflet 3164, on type C switchboard watt-hour meters; leaflet 3892, on type E elevator brake magnets; leaflet 3931, on type 3-19 automatic electric range; leaflets 3937 and 3938, on type 2-19 automatic electric range. In one of these publications (catalog 5-B), announcement is made that in all the company's literature the words "resistance," "resistor" and "rheostat" will have standardized meanings as follows: Resistance is a physical property of a body by virtue of which the body limits the intensity of an electric current; a resistor is a body interposed in a circuit for the purpose of introducing resistance; a rheostat is a combination of a resistor and a device whereby the effective resistance of the resistor can be varied.

Anderson Electric Specialty Company, 562 West Van Buren Street, Chicago, Ill., has issued bulletin No. 100, descriptive of its "Reel-Feature" electric-lighting and automobile specialties. The "Reel-Feature" consists of a ball casing containing a winding mechanism and a drum capable of winding 10 feet of lamp cord.

R. S. Mueller & Company, 423 High Avenue, S. E., Cleveland, O., have ready for distribution copies of a circular that should prove of interest to automobile owners and garage men. It illustrates a new universal test clip made of lead-covered steel so as to be especially suitable for very quickly connecting up automobile storage batteries for charging. By its use it is not even necessary to remove a lighting or starting battery from the car when charging. In garages a group of such batteries can be connected for charge in a few moments.

Publicity Bureau of Associated Metal Lath Manufacturers Moves to Cleveland.—Announcement has been made by the Publicity Bureau of the Associated Metal Lath Manufacturers that its officers have been moved from Chicago to the Swetland Building, Cleveland, O., and that Zenas W. Carter, formerly of Boston, and first general secretary of the Electric Development Association when it was incorporated in New England, has been appointed commissioner, to supervise all their publicity, promotion and investigation from the Cleveland office.

Midwest Electric Company Banquets Salesmen.—Thirty salesmen of the Midwest Electric Company, Omaha, Neb., were guests of the firm at its fifth annual salesmen's congress banquet held April 3 in Omaha. A three-day sales conference was held. M. J. Wolf, of W. N. Matthews & Brother, St. Louis, Mo., was the principal speaker at the banquet, his subject being "The Study of Human Elements in Business and How to Approach Customers." E. L. Barr, of Des Moines, Iowa, district manager of the General Electric Company, spoke on "Co-operation." G. W. Johnson, president, and S. A. Seabury, secretary, of the Midwest company, also addressed the salesmen at the banquet.

Bryant Electric Company Issues Dimension Sheets for Flush Switch Plates.—Notwithstanding the very complete information which is given in the catalog of the Bryant Electric Company, Bridgeport, Conn., it has been found that a great many architects do not find it convenient to make use of some of the information, particularly with reference to the overall dimensions of flush switch plates. To facilitate the use of this information when necessary, the company has issued a special dimension sheet, which will enable any architect or architectural draftsman to readily place the switches on his plans. Copies of these prints will be gladly supplied by the Bryant Electric Company upon request.

Stauble & Salvini, 76-Foro Bonaparte, Milan, Italy, electrical jobbers, have announced that their organization is well equipped for the selling of electrical apparatus and material, including generators, motors, lamps, meters, insulating material, telephone material, switchboard material and electric railway material. It is stated that they have the best of relations with all of the industrial companies, telephone companies, jobbers and merchandising houses of Italy—relations acquired during many years of trading and the sale of both domestic and foreign products. At the present time the firm desires to extend its connections for the sale of equipment manufactured in other countries, and wishes to place its organization and facilities for trade at the disposition of any reliable house which wishes to be represented in Italy. They would be glad to receive the catalogs and conditions of sale of any of American manufacturers who may be interested.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standard of the National Electric Code as recommended by the National Fire Protection Association

ATTACHMENT PLUGS, Fuseless.—Harvey Hubbell, Inc., Bridgeport, Conn.
Cord Connector, 10 amperes, 250 volts, catalog No. 6821.
Listed February 27, 1915.

COOKING APPLIANCES.—Rutenber Electric Company, Marion, Ind.
"Reco" toaster, 500 watts, 110 volts, Model 65.
Listed March 3, 1917.

CUTOUT BASES, Plug Fuse.—Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill.
A composition base in which are moulded screw-shell contacts for plug fuses, and intended for mounting over busbars on slate panels. "Chicago Safety Panel Cutout," 0-30 amperes, 125 volts.
Listed March 10, 1917.

DOOR OPENER AND CLOSER.—Mechanical Products Company, 537 South Dearborn Street, Chicago, Ill.
Automatic motor-operated door opener and closer, operating through medium of a drum and steel cable and controlled by push-button stations and limit switches connected to a relay which controls the motor and direction of rotation. "Stewart," ¼-horsepower or less, 110 or 220 volts, alternating or direct current.
Listed February 17, 1917.

FIXTURES.—W. F. Mahoney, 523 East Main Street, Richmond, Va.
Label service.
Listed March 5, 1917.

OUTLET PLATES.—R. & H. Manufacturing Company, 1551 Columbus Road, Cleveland, O.
Outlet plates for straight electrical and combination fixtures. Pressed steel, catalog No. 3½-L. "R. & H."
Listed February 13, 1917.

PANELBOARDS.—Standard Electrical Construction Company, 60 Natoma Street, San Francisco, Cal.
Consisting of an assembly of bus bars, with or without standard cutout parts, or with or without standard switches mounted on insulating bases. Designed for use on low-potential circuits.
Listed March 5, 1917.

RECEPTACLES, Medium Base.—The Bryant Electric Company, Bridgeport, Conn.
"Bryant" or "Perkins." Keyless, catalog No. WE-12026.
Listed February 8, 1917.

RECTIFIERS.—General Electric Company, Schenectady, N. Y.
Hot cathode argon-gas-filled rectifier, consisting of a rectifier tube, compensator and fuses in an enclosing case. Designed for battery charging. Type GSP for use on 125-volt, alternating-current circuits, two and six amperes, direct current.
Listed March 6, 1917.

RESISTANCE APPLIANCES.—General Electric Company, Schenectady, N. Y. Motor-starting rheostat panels, Type CR-2273.
Listed March 6, 1917.

ROSETTES, Fuseless.—John I. Paulding, New Bedford, Mass.
"Paulding." Three amperes, 250 volts, catalog Nos. 2693B, 2694B, 2755.
Listed January 27, 1917.

SIGNALING SYSTEMS.—Telautograph Corporation, 448 West Thirty-Seventh Street, New York, N. Y.
Special mechanism in which pencil on transmittor is so connected with two current-carrying rheostats that by movement of pencil while writing, varying currents are sent over wire lines which operate receiving pen in unison, thus reproducing motions of transmitting pencil and duplicating its writing. Telautograph.
Listed January 15, 1917.

SWITCHES, Enclosed. — Detroit Fuse & Manufacturing Company, Detroit, Mich.
Two-pole, knife switches and cutout bases for standard plug or cartridge enclosed fuses. Enclosed in metal case and designed for manual operation without opening cases. Square D, 0-200 amperes, all standard voltages, catalog Nos. 5211-E, 5251-X, 5252-54, inclusive, 5261-64, inclusive, 5311-E, 5341-44, inclusive, 5351-X, 5352-54, inclusive, 5361-64, inclusive, 5441-43, inclusive, 5452-53, 5461-63, inclusive. Service switches and distributing centers, 0-30 amperes, 125-250 volts; catalog Nos. 2001-03, inclusive, 2011-13, inclusive, 2051-53, inclusive.
Compensator type, 0-200 amperes, 0-600 volts, catalog Nos. 58341-43, inclusive, 58351-54, inclusive, 58364.
Motor-starting type, 0-60 amperes, 0-600 volts, catalog Nos. 65341-2, 65351-2, 66341-2, 66351-2.
Listed February 5, 1917.

SWITCHES, Enclosed. — Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y.
Two, three or four-pole, quick-break, double-break, brush type switches and cutout bases for standard cartridge enclosed fuses, enclosed in metal cases and designed for manual operation without opening cases. Doors of cases lock automatically when switches are thrown into "on" position. When cases are open, fuse terminals and all accessible parts are "dead," eliminating possibility of shock to operator in replacing or inspecting fuses.
"Krantz Safety Auto-Lock," 0-200 amperes, 250 volts; 0-200 amperes, 500 volts, alternating current, catalog Nos. 2AL3, 2AL6, 2AL10, 2AL20, 3AL3, 3AL6, 3AL10, 3AL20, 4AL3, 4AL6, 4AL10, 4AL20, 12AL3, 12AL6, 12AL10, 12AL20, 13AL3, 13AL6, 13AL10, 13AL20, 14AL3, 14AL6, 14AL10, 14AL20.
Listed January 26, 1917.

SWITCHES, Fixture.—The Bryant Electric Company, Bridgeport, Conn.
"Bryant" or "Perkins." Single-pole. Pull, Brascolite, catalog No. 75.
Listed February 27, 1917.

SWITCHES, Fixture.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
"C-H." Single-pole. Pull, catalog Nos. 7311-17.
Listed February 19, 1917.

SWITCHES, Knife.—D. & W. Fuse Company, Providence, R. I.
Magnetic chuck control switch, consisting of a small inclosed double-pole, double-throw knife-switch and resistance coil with switch operated by external lever, and arranged either to connect coils of magnetic chuck directly to line or to connect them in series with resistance coil and reverse direction of current. 4 amperes, 125 volts; 2 amperes, 250 volts; catalog No. 9.
Listed February 26, 1917.

SWITCHES, Knife. — Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
"Westinghouse." Standard voltage rating, 30-200 amperes, inclusive. Type C. Standard voltage ratings, all capacities. Type A.
Listed February 8, 1917.

SWITCHES, Master. — The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
Push button stations for use with automatic switches and controllers. "C-H2" Bulletin No. 10250.
Listed February 2, 1917.

SWITCHES, Master.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
Push button stations for use with automatic switches and controllers. "Westinghouse" 6-25 amperes, 600 volts, five amperes, 250 volts. Drum type controllers for use with automatic switches. "Westinghouse" two amperes, 600 volts, four amperes, 250 volts.
Listed February 2, 1917.

TUBING, Flexible.—Triangle Conduit Company, Inc., 50 Columbia Heights, Brooklyn, N. Y.
Marking.—Knitted construction.
Listed February 5, 1917.

WELDING MACHINE.—Detroit Electric Welder Company, 253 LaFayette Avenue, Detroit, Mich.
Electric welding machines, Detroit. Types B. D. P. S. KK, KS, KV. 20 kilowatts and less, 110 or 220 volts.
Listed February 5, 1917.

WIRE, Rubber-Covered.—Habirshaw Electric Cable Company, Yonkers, N. Y.
Marking: Three blue threads parallel in braid or one blue thread under braid
Listed February 14, 1917.

PERSONAL AND BIOGRAPHICAL

MR. A. O. CURTIS has become superintendent of the municipal electric plant at Tekamah, Neb., succeeding MR. A. F. RHODES, resigned.

MR. O. R. EMERSON, who has been superintendent of the municipal electric-lighting plant in Monroe City, Mo., for the past 15 years, has resigned to accept a position in Hannibal, Mo.

MR. BION J. ARNOLD, of Chicago, Ill., has been engaged to make a survey of the traction system of the Harrisburg (Pa.) Railways Company, with a view to extensions and betterments.

MR. A. J. CATES, manager of the San Joaquin Light & Power Corporation's office in Corcoran, Cal., has resigned to accept a position with the Pacific Gas & Electric Company at Stockton, Cal.

MR. H. H. STEVENS, manager of the Consumers Power Company's branch office in Charlotte, Mich., has been appointed manager of the company's district comprising Albion, Battle Creek and Charlotte. He is succeeded at Charlotte by MR. GEORGE CASTLE, formerly of Albion.

MR. THOMAS McENROE, division superintendent of the Norfolk branch of the Connecticut Power Company, has been transferred to Thomaston to act as division manager of the Thomaston branch. MR. VINCENT J. BYRON, assistant to Mr. McEnroe for the last three years, succeeds him at Norfolk.

MR. UNION N. BETHELL, of Montclair, N. J., senior vice-president of the American Telephone & Telegraph Company, has accepted an appointment tendered by Governor Edge of New Jersey to be a member of the commission to investigate the condition of state institutions now under the direction of the Bureau of Charities and Corrections.

MR. CONRAD H. SHAW, for the past two years electrical engineer of the Sheboygan (Wis.) Electric Company, now merged in the Eastern Wisconsin Electrical Company, has resigned his position to become electrical engineer of the Minnesota Public Utilities Company, Chisholm, Minn., which operates a number of utilities in that state.

MRS. LENA B. CARR, of Rutland, Vt., has been appointed manager of the new-business department of the Hortonia Power Company and its subsidiaries, the Eastern Vermont Public Utilities Corporation and the Port Henry Light, Heat & Power Company. The Hortonia company serves 30 towns in northern Vermont and eastern New York.

MR. RICHARD T. SULLIVAN, who has since April, 1916, been manager of the railway interests of the Mahoning & Shenango Railway & Light Company, of Youngstown, O., has been made general manager of the company in charge of the operation of all departments, filling a vacancy which has been left standing since the resignation of MR. J. F. WESSEL. Mr. Sullivan's position as manager of the company's railway lines will now be filled by his assistant, MR. R. N. GRAHAM.

MR. FRANCIS T. HOMER, vice-president of the United Gas & Electric Corporation, New York City, has been elected president of the American Cities Company, New York City, to succeed MR. HUGH McCLOSKEY, who has been actively connected since 1908 with the American Cities Company and the New Orleans Railway & Light Company, which is controlled by the former company.

MR. PAUL M. LINCOLN, commercial engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed a captain of the Engineers Corps in the United States Army. This announcement comes with that of the appointment of a number of prominent engineers in the country to positions in the army, all made by President Wilson in his appreciation of the importance of securing the ability and training of the country for use in national defense measures. Mr. Lincoln is a graduate of Ohio State University, class of 1892, and has for 24 years been associated with the Westinghouse company. He is a past president of the American Institute of Electrical Engineers and has done much in the interest of that organization. His recent appointment will undoubtedly meet with the most hearty approval of the electrical engineering profession.

P. M. Lincoln.

MR. J. B. SHICKEL, formerly in the Chicago offices of the General Electric Company, has become superintendent of the Menominee & Marinette Light & Traction Company, Menominee, Mich.

MR. T. NORMAN JONES, JR., has been appointed assistant general manager of the Virginia Railway & Power Company, Norfolk, Va., succeeding MR. E. C. HATHAWAY, resigned.

MR. W. F. SCHAPHORST, advertising engineer, has established an engineering advertising service office in the Woolworth Building, New York City, and is accepting accounts from manufacturers of high-grade engineering products. Mr. Schaphorst has been a frequent contributor to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

MR. L. A. WRIGHT has been appointed local manager of the San Diego (Cal.) Consolidated Gas & Electric Company at Escondido, Cal., to have charge of the gas and electric utilities in that district recently taken over by the company for operation.

MR. HERMAN LEVERANCE, formerly of the New York office of Henry L. Doherty & Company and later of the Mansfield (O.) Electric Light & Power Company, has left the employ of the Doherty organization, and is now with the Carnegie Steel Company, Youngstown, O.

MR. E. P. DILLON, formerly assistant to manager of the Railway and Lighting Department of the Westinghouse Electric & Manufacturing Company, East Piftsburgh, Pa., has been appointed manager of the power division of the New York office. Mr. Dillon is a graduate of the University of Colorado. Prior to 1909 he was connected with the Colorado Springs (Colo.) Light & Power Company.

MR. ROBERT THISTLEWHITE, lately connected with the New York Electrical School, but who made a wide acquaintance through his connection with the contracting and illuminating engineering firms of G. W. Warner and the Central Electrical Supply Company, has taken charge of the illuminating and jobbing department of Renard & Stary, contractors, Los Angeles, Cal. Mr. Thistlewhite has had considerable experience along these lines and was chosen by the New York Electrical School to commence its department of interior light and power wiring and also its illuminating engineering course.

MR. HENRY F. ALBRIGHT, general superintendent of the Western Electric Company, has been elected a vice-president of the company. Mr. Albright has been connected with the Western Electric Company since 1892, when he became a salesman in the Chicago office. Two years later he was transferred to the construction department, and in 1897 became factory engineer at New York. In 1899 he was made superintendent at New York, and in 1908 general superintendent at the Hawthorne works. Mr. Albright is a Fellow of the American Institute of Electrical Engineers, a member of the Institute of Electrical Engineers, London, and other engineering organizations.

MR. H. M. BYLLESBY, of H. M. Byllesby & Company, president of the Chicago Civic Federation, in addressing the conference of the committee on engineering co-operation at its banquet in the Auditorium Hotel recently said: "The United States today is standing in the shadow of a peril far greater than any in this room appreciate. Our duty is to read the signs of the time, which are writ so bright that even almost the blind can read them. We should prepare against invasion and internal revolution, both of which, to my mind, are imminent." Mr. Byllesby was applauded when he announced he had informed the federal government that, in case of war, his services in any capacity were at the disposal of the nation, without pay.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

ASHLAND, N. H.—At a special town meeting March 27 it was voted to purchase the plant of the Ashland Electric Light Company. The town voted $50,000; $25,000 to acquire the plant, $9,500 for an option on water power rights of the Asquam Lake Lumber Company, and the remainder for improvements to the newly acquired electric property. J. C. Huckins, Frank Fifield and Louis E. Brooks were chosen electric light commissioners.

CONCORD, N. H.—The Canaan-Enfield Electric Company has been acquired by the Central Light & Power Company, of Boston.

CONCORD, N. H.—The Twin State Gas & Electric Company, of Brattleboro, Vt., has been authorized by the Public Service Commission to issue $31,000 in 40-year, five-per-cent gold bonds, to pay for plant additions.

EAST HAMPTON, CONN.—The East Haddam Electric Light Company and the Colchester Electric Light Company have been consolidated under the name of the Central Connecticut Power & Light Company, with headquarters at East Hampton. The new company will continue the electric service in the towns of East Hampton, East Haddam, Higganum, Glastonbury, East Glastonbury, Moodus, Haddam, Colchester, Cobalt and Hadlyme. During the last three years the former companies have increased the number of customers and the receipts over fifteen times. Arthur B. Lisle is president of the new company, and L. P. Perry is general manager.

HARTFORD, CONN.—The Connecticut Senate has passed a bill which authorizes the Meriden Electric Light Company to increase its capital stock from $500,000 to $1,000,000.

NEW HAVEN, CONN.—The aldermanic committee on street lighting is considering extensions to the local white-way system.

MIDDLETOWN, N. Y.—The up-state Public Service Commission has authorized the Orange County Public Service Corporation, of Middletown, to take over the Murray Electric Light & Power Company, the Orange County Power Company, Port Jervis Light & Power Company, and the Orange County Light Company, for a consideration of $1,600,000. The new corporation will issue $350,000 common and $250,000 seven-per-cent preferred stock at not less than par, and $1,200,000 first-mortgage 45-year five-per-cent bonds at not less than 87.5.

SENECA FALLS, N. Y.—The Municipal Board is negotiating with the Empire Gas & Electric Company for electric service for street lighting.

SYRACUSE, N. Y.—C. H. Livingson, superintendent of the penitentiary, has recommended the installation of the following equipment at the institution: Boiler equipment, $6,000; furnaces, $3,000; water purifier, $2,000.

JERSEY CITY, N. J.—The Public Service Electric Company has acquired a tract of property, about 200 by 830 feet, extending from Halsey Street to the Hackensack River, adjoining its Marion power station, and is reported to be planning extensions.

JERSEY CITY, N. J.—The Board of Freeholders is planning the installation of electric flood-light projectors on bridges over the Passaic and Hackensack Rivers. The Board of Freeholders of Essex and Bergen Counties will be interested in the improvement.

LITTLE FALLS, N. J.—The Common Council is negotiating with the Board of Freeholders for the installation of new street lamps.

NEWARK, N. J.—The Board of Public Utility Commissioners has granted the Public Service Railway Company permission to issue $2,000,000 in capital stock for extensions.

NEWARK, N. J.—A new boiler system will be installed by the County Freeholders at Overbrook Hospital, to cost $59,900. The Union Supply & Construction Company, 28 Houston Street, Newark, will make the installation.

PATERSON, N. J.—The Board of Public Works is considering the extension of the white-way system in Market Street, between Main and Cross Streets.

PERTH AMBOY, N. J.—Property owners on Washington Street, forming the State and Washington Streets Taxpayers' Association, have petitioned the Board of Aldermen for the installation of an improved street-lighting system on Washington Street.

PERTH AMBOY, N. J.—The Public Service Electric Company has notified the city that it is planning the installation of an underground conduit system in Commerce and High Streets, for its local plant, operated under the name of the Citizens' Electric Light, Heat & Power Company. The company will install a new steam turbine in its plant on Buckingham Avenue.

TRENTON, N. J.—The John A. Roebling's Sons Company will build a new power house at its wire-rope manufacturing plant on Canal Street.

TRENTON, N. J.—The Trenton Gas & Electric Company has filed plans for the erection of two one-story additions to its station on New York Avenue.

WOODCLIFF (Weehawken), N. J.—North Bergen Township Committee has awarded a five-year street-lighting contract to the Public Service Electric Company.

BELLEFONTE, PA.—A. J. Musser, M. S. Mitchell and P. T. Davis, Clearfield, Pa., have been granted state charters for five electric companies, to furnish electric light and power service in the Juniata Valley section. The companies are as follows: Fermanagh Township Electric Company, Wheatfield Township Electric Company, Penn Township Electric Company, Rye Electric Company and Watts Township Electric Company. The capitalization is $5,000 each.

CHESTER, PA.—A one-story power plant, 58 by 82 feet, will be installed at the new factory on Fifth Street, to be erected by the McCausland Engineering Company, Pennsylvania Building, Philadelphia.

ERIE, PA.—The Erie Lighting Company has awarded a contract for the erection of its new power plant at a cost of about $150,000. Henry Schenk, Erie, will build the structure.

HARRISBURG, PA.—The Bell Telephone Company is planning local improvements, to cost about $134,290. The work will include the installation of new underground conduits, 12,000 feet of underground cable, and 5,100 feet of aerial lines. The line installation will cost $78,000.

HARRISBURG, PA.—Officials of the Harrisburg Light & Power Company have announced that the capital stock of the company will be increased to $1,500,000 at a meeting of the directors to be held June 4. The increase is said to be for improvements already completed and for those now contracted for, which include the installation of a $100,000 stoker and line extensions.

MAHANOY CITY, PA.—The Philadelphia & Reading Coal & Iron Company will install a system of electric-driven pumps for sewerage and water at Gilberton. W. J. Richards is president.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad has awarded a contract for the erection of the proposed new engine and boiler station at its Rutherford shops, to cost $50,000.

READING, PA.—The Metropolitan Electric Company has commenced the construction of a new high-tension line from its power station in West Reading to the Wernersville district, to furnish service for industrial plants. The company has recently completed a line from the station to Temple and Leesport.

STEELTON, PA.—The City Council is negotiating wth the local utility companies for the installation of an underground conduit system on Front Street, for the elimination of all overhead lines. T. T. McEntee, president of the Municipal League, is interested in the improvement.

SUNBURY, PA.—The Electric Bond & Share Company, 71 Broadway, New York, is considering the installation of an ornamental street-lighting system with concrete standards.

BECKLEY, W. VA.—The Public Service Commission has granted the Beckley Electric Light & Power Company permission to put into effect a rate of three cents per kilowatt-hour for use of electricity for cooking and heating purposes.

WHEELING, W. VA.—The American Gas & Electric Company will build a new power house.

CHARLOTTE, S. C.—The Southern Public Utilities Company is planning to furnish service to the Jackson Cotton Mills, Iva, S. C., and to the Watson Cotton Oil Company, Starr, S. C.

FOUNTAIN INN, S. C.—Estimates for the establishment of a municipal electric-lighting plant are being prepared by John N. Ambler, engineer, Winston-Salem, N. C.

AMERICUS, GA.—The Americus Public Service Company, which recently took over the properties of the local public utilities, will install considerable new equipment. Headquarters are at the Munsey Building, Baltimore, Md.

ATLANTA, GA.—Asa G. Candler, Inc., will build an annex to the Ansley Hotel, to cost $300,000, with complete electrical equipment.

CLEVELAND, GA.—W. E. White, of Jefferson, Ga., will construct a hydroelectric plant on Turner Creek, to develop about 100 kilowatts.

DAVISBORO, GA.—W. M. Crook, Macon, Ga., is preparing plans for an electric-lighting plant to be built by the city.

FOLKSTON, GA.—J. W. Buchanan, of Folkston, has constructed a dam across a creek near the city limits, and will build a power plant for the purpose of lighting Folkston and furnishing energy for manufacturing plants.

THOMASVILLE, GA.—An election will be held April 27 to vote on the issuance of $160,000 of municipal bonds, part of the proceeds to be used for installing a municipal electric-lighting plant and a fire-alarm system.

COCOA, FLA.—The Cocoa Light & Ice Company will install additional generating equipment and furnish 24-hour service.

ORLANDO, FLA.—About $10,000 will be expended for a fire-alarm system here.

ST. CLOUD, FLA.—The mayor is contemplating the issue of bonds for installing an electric-lighting plant.

NORTH CENTRAL STATES.

LORAIN, O.—In connection with the erection of its new power plant between Second Street and the West Side lake front, the Lorain County Electric Company will build a pier equipped with railroad tracks and also designed for the unloading of vessels. Construction work on the power plant will begin about April, according to J. B. Johnson, general manager of the company.

DECATUR, IND.—The local power house of the Ft. Wayne & Decatur Interurban Railroad was struck by lightning last week and destroyed by the fire that ensued. The total loss is estimated at $50,000.

MICHIGAN CITY, IND.—The Board of Public Works is receiving bids for furnishing electrical energy for the operation of centrifugal pumps at the municipal waterworks plant.

NAPPANEE, IND.—The local water and light plant has been sold by the town to the Nappanee Utilities Company for $50,000. The town is one of the incorporators of the new company, and in this way will be able to improve the plant without exceeding the legal debt limit.

DECATUR, ILL.—The Board of Local Improvements has recommended to the City Council approval of an ordinance providing for the installation of an ornamental electric-lighting system in South Main and East Wood Streets. The improvement involves an estimated outlay of $2,537.

IRONWOOD, MICH.—The Ironwood & Bessemer Railway & Light Company has commenced the installation of a white-way system in Aurora Street.

PETOSKEY, MICH.—A contract for electrical machinery for improving the local light and power plant has been awarded to the Electric Machinery Company, of Minneapolis, Minn.

ROYAL OAK, MICH.—A contract has been voted by Royal Oak Township for the lighting of Woodward Avenue through the township. The installation of lighting equipment will be made by the Detroit Edison Company.

ASHLAND, WIS.—The L. E. Meyers Company is making plans for extensive improvements to its local electric light and power plant.

ANOKA, MINN.—The municipal electric plant here has been shut down and service is being secured from the hydroelectric plant at Coon Rapids.

CROSBY, MINN.—The Village Council is considering plans for the establishment of a municipal electric-lighting plant.

ADEL, IOWA.—A loss of about $20,000 was sustained by the Adel Light & Power Company recently when high water caused the failure of the company's dam.

ALBIA, IOWA.—The Albia Light & Railway Company is making extensive improvements to its plant. Ralph W. Boyer is manager of the company.

CEDAR RAPIDS, IOWA.—The Nebraska Electric Company has been incorporated with a capital of $20,000, to construct, purchase and operate electric light and power plants. The officers of the new company are: C. L. Van Valkenburg, president; Richard Lord, vice-president; W. M. Deacon, vice-president; M. M. Thompson, secretary-treasurer, and D. E. Howell, assistant secretary.

DANBURY, IOWA.—A franchise has been granted to Mark and Godfrey Drust to operate electric transmission lines for distribution of electricity in Woodbury County.

LITTLE ROCK, IOWA.—The City Council is planning ways and means to secure a municipal electric-lighting system.

NEW VIENNA, IOWA.—A franchise has been granted to the Eastern Iowa Electric Company, of Dubuque, for supplying electric service here. The company's transmission line to Dyersville will be extended to this place.

RICH HILL, MO.—New generating equipment will probably be installed in the local electric-lighting pant.

SMITHVILLE, MO.—The local electric-lighting plant, owned by Harry G. and Crawford Morton, was completely destroyed by fire recently, causing a loss of $7,500. The plant may be rebuilt.

ALMA, KANS.—The Alma Light & Ice Company signed a contract with the Rocky Ford Milling & Power Company to furnish energy for Alma by October 1, 1917. The Rocky Ford company will construct its lines through Wamego.

DENTON, KANS.—The city is to build an electric distribution system, the energy for which will be received by means of a transmission line from Severance.

HAZELTON, KANS.—P. D. Preston has purchased the local electric-lighting plant.

INDEPENDENCE, KANS.—The proposition to vote bonds for securing a municipal electric plant was defeated at the recent city election.

LONG ISLAND, KANS.—The Council will take action soon on the electric-lighting proposition. A transmission line may be built from Prairie View.

MARYSVILLE, KANS.—John Krug, of Herkimer, will build a transmission line from Marysville to Herkimer, to supply that city with electricity for light and power. The energy will be sold to Mr. Krug by the Marysville Light, Power & Water Company.

MINERAL KANS.—Electric power for street lighting and coal-mine operation here will probably be furnished by the Empire District Electric Company.

PRESCOTT, KANS.—An electric-lighting system is contemplated here.

QUINTER, KANS.—Bonds have been voted for a municipal electric-lighting plant, work on which will be commenced soon.

STAFFORD, KANS.—The Council has voted to purchase a new steam engine for the electric plant.

YATES CENTER, KANS.—Bonds for municipal ownership of street-lighting and water plants carried at an election held here last week.

BEAVER CITY, NEB.—The city may issue $7,000 in bonds, to provide additional electric equipment so 24-hour service may be inaugurated here.

MOBRIDGE, S. D.—J. W. Ferris, of the Ferris Brothers System, which owns electric plants in Watertown and in other South Dakota cities, and which recently purchased the local electric plant from Bert C. Hill, has been in Mobridge on development work, which will include the erection of a new plant here at a cost of about $75,000.

WHITE LAKE, S. D.—At the city election April 17 the question of issuing $10,000 bonds for the construction of a municipal electric-lighting system will be considered.

LA MOURE, N. D.—The local electric plant has been sold to O. E. Jackson, of Eureka, C. J. Johnson, of La Moure, and others.

DATES AHEAD.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

American Electrochemical Society. Spring meeting, Hotel Statler, Detroit, Mich., May 2-5. Secretary, J. W. Richards, Lehigh University, South Bethlehem, Pa.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Missouri Association of Public Utilities. Annual meeting, aboard Steamer *Quincy* en route from St. Louis, May 17-19. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 23-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Iowa Section, National Electric Light Association. Annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

Electric Power Club. Spring meeting, Homestead Hotel, Hot Springs, Va., June 11-14. Secretary, C. H. Roth, 1410 West Adams Street, Chicago, Ill.

American Institute of Electrical Engineers. Annual meeting, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

SOUTH CENTRAL STATES.

LEXINGTON, KY.—The Kentucky Utilities Company is constructing a transmission line from Glasgow, Ky., to Horse Cave, and another from Morganfield to Union City and at Central City is in the midst of extensive improvements to the local plant.

LOUISVILLE, KY.—The Standard Oil Company of Kentucky has purchased two 300-kilowatt General Electric turbines, together with switchboard and accessories, and motors. The company is erecting a large refinery in Louisville and will operate an isolated plant.

SCOTTSVILLE, KY. — The Scottsville Electric Light Company has changed its name to the Scottsville Light & Power Company.

JOHNSON CITY, TENN.—The city has been authorized by the Legislature to acquire the local electric-lighting plant.

MEMPHIS, TENN.—The Illinois Central Railroad will install a large amount of electrical equipment at the coach-cleaning plant to be erected near this city.

SOMERVILLE, TENN.—The city is making plans for the enlargement of its electric plant.

ANNISTON, ALA.—The Anniston Steel Company is installing three additional electric furnaces for the manufacture of steel. The additions give the company a battery of six furnaces.

BIRMINGHAM, ALA.—The Sloss-Sheffield Steel & Iron Company is planning to install an electric haulage system at the mines. If this is done in all the mines of the company, nearly $1,000,000 will be expended. Waddill Catchings is the president of the company, with offices in this city.

GENEVA, ALA.—The Geneva Power & Manufacturing Company is considering the development of a power site which it has just purchased near the city. D. O. Vaughn is president.

GREENSBORO, ALA.—The property of the Greensboro Light & Ice Company has been purchased by H. C. Armstrong, president of the City National Bank, and others.

ONEONTA, ALA.—The Oneonta Utilities Company has been incorporated with a capital of $4,000 by J. B. Harvey and W. A. Weaver, and will operate an electric plant and ice factory here.

TYLERTOWN, MISS.—The Tylertown Electrical Company contemplates building a power station and installing an additional generating unit in order to give 24-hour service.

BEARDEN, ARK.—The Bearden Electric Light Company has secured a franchise to construct and operate an electric-lighting plant here.

McGEHEE, ARK.—The city will double the capacity of the electric-lighting plant, installing a 120-horsepower oil engine, 100-kilowatt alternating-current generator and other equipment. H. W. Wright is in charge of the plant.

RAYNE, LA.—Proposals are being received here for the purchase of bonds, the proceeds to be used for improvements to the municipal electric-lighting plant.

BUTLER, OKLA.—At an election April 3 bonds in the sum of $6,000 will be voted on for a municipal electric-lighting plant.

DONNA, TEX.—The Donna Light & Power Company, which has been incorporated here with a capital stock of $5,000, will install an electric light and power plant.

WOODVILLE, TEX.—The Woodville Light & Power Company will install machinery for an electric light and power plant here. J. M. Williams is a stockholder.

WESTERN STATES.

EUREKA, MONT.—A special election will be called to vote on the question of granting an electric franchise to J. J. Tetrault and associates, who propose to make a hydroelectric development on Grave Creek at an estimated cost of $60,000.

POPLAR, MONT.—The City Council may grant an electric franchise to a private company.

ENGLEWOOD, COLO.—A proposition to issue bonds to provide for a municipal electric-lighting plant will be submitted to a vote.

DOUGLAS, ARIZ.—The Douglas Traction & Light Company has been awarded the contract to install the street-lighting system on G Street and will have the construction work done within five or six weeks.

KINGMAN, ARIZ.—The Chloride X-Ray Mining Company will install a power plant at its mine, consisting of a 100-horsepower engine and five drill compressors.

NOGALES, ARIZ.—A street-lighting system, to cost about $20,000, will soon be installed in the business and residential sections of Nogales. The plans call for ten five-lamp clusters on posts about 120 feet apart in the business district. About 150 bracket lamps will be distributed in the residential section, not less than 200 feet apart. These lights will have 100-watt lamps.

WICKENBURG, ARIZ.—This city has voted $12,000 bonds for the installation of an electric light and power plant. The contract will be let at once.

DRUMMOND, IDAHO.—A special election has been called for April 24 to vote bonds for the construction of an electric-lighting system here.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company is making plans for improving its service in Cottonwood, Idaho.

POCATELLO, IDAHO.—Citizens here are discussing plans for a proposed municipal electric light and power plant.

ROCKLAND, IDAHO.—The Idaho Power Company has applied for a franchise to furnish street-lighting service here.

BELLINGHAM, WASH.—Plans are under way for the installation of a power plant to generate electricity for lighting the Whatcom High School.

EPHRATA, WASH.—Plans for the enlargement of the local light and power system are under way. A new plant will be installed by Mr. Nelson in the near future, at a cost of about $10,000. Lines will be extended to Soap Lake.

OTHELLO, WASH.—A municipally owned electric plant, to be built at a cost of $14,000, will be erected here soon and the entire lighting system will be overhauled and improved.

PALOUSE, WASH.—The City Council has granted the Washington Water Power Company a 25-year franchise to furnish electric light, power and heat in Palouse. The

local system of the power company will be rebuilt and modernized.

SEATTLE, WASH.—The Alaska Engineering Commission has called for bids for furnishing wire, equipment and supplies necessary for the installation of a telephone system at Anchorage and improvements to the telegraph system in the north.

SPOKANE, WASH.—The Pacific Power & Light Company has applied to the Board of County Commissioners for a franchise to construct a high-tension transmission line through Franklin County to connect with the Washington Water Power Company's transmission line at Lind.

TACOMA, WASH.—The City Council will probably place before the voters soon the question of bonding the city in the sum of $4,500,000, for which $1,000,000 will be used to purchase the Hebb power-site, and $3,500,000 to develop it to its full capacity of 100,000 horsepower.

PORTLAND, ORE.—Plans are under way to build a steam electric plant immediately as a preliminary to the proposed hydroelectric plant to be built in the Bull Run Reserve at a cost of $350,000. The temporary plant will be used as an auxiliary plant when the new hydroelectric plant is established.

GRENADA, CAL.—A survey is being made for a new electric railway to be built from Grenada to Moffit Creek.

LODI, CAL.—The Business Men's Association has secured the necessary money and an ornamental electric-lighting system will be installed here at an early date.

LOS ANGELES, CAL.—Floyd Brown has applied to the State Railroad Commission for authority to install an electric light and power plant at Blythe.

LOS ANGELES, CAL.—The City Council has ordered an electric-lighting system installed and energy furnished for the lighting of portions of Olympia and Laconia Boulevards, and Figuerora, 121st and 124th Streets.

PASADENA, CAL.—The city proposes to install a municipal railway system at a cost of $2,500,000.

SACRAMENTO, CAL.—The Walker Mining Company is starting work on the development of hydroelectric power on Ward Creek, five miles from Genesee.

STRATFORD, CAL.—Plans are under way for the formation of a lighting district in Stratford, a petition signed by more than 25 property owners having been presented to the Board of Supervisors.

Proposals

ELECTRICAL CONSTRUCTION. — Bids will be received by the city of Rayne, La., until April 23 for supplying and erecting machinery and equipment for the improvements of its municipal water and light plant according to the plans and specifications prepared by Harold Raymond, consulting engineer, Interstate Bank Building, New Orleans, La.

ELECTRIC LIGHTING APPARATUS.—Bids will be received by the Board of Water Supply, at its offices, Municipal Building, Centre and Chambers Streets, New York City, until April 24, for Contract 168, for furnishing, delivering, installing and testing complete electrical-lighting apparatus along the Catskill aqueduct; also for furnishing and installing a motor and gearing and an electrically driven pump. The work is located between the Ashokan reservoir, near Ashokan, Ulster County, and Silver Lake reservoir, Staten Island, New York. Pamphlets containing drawings can be obtained at the above address by depositing ten dollars. George Featherstone, Secretary, Commissioners, Board of Water Supply.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 911, Washington, D. C., two induction motors. Schedule 930, Brooklyn, N. Y., 300,000 feet of incandescent-lamp cord, 365,000 feet of duplex rubber-covered wire, 175,000 feet of single rubber-covered wire, 60,000 feet of telephone wire, 60,000 feet of lead-sheathed cable and 180,000 feet of portable ship-lighting cable. Schedule 931, Brooklyn, N. Y., and Charleston, S. C., miscellaneous lighting cable. Schedule 931, Mare Island, Cal., and Puget Sound, Wash., miscellaneous magnet wire. Schedule 931, various navy yards, miscellaneous interior communication cable, telephone cable, telephone portable cord, antenna wire, bell wire, ignition wire, lighting and power wire, and single and double-conductor wire. Bidders desiring to submit proposals should make application to the Bureau or to the nearest navy yard purchasing office.

Incorporations

SUFFOLK, VA.—Holladay Detecto Company. Capital, $125,000. Manufacture electrical devices.

SEATTLE, WASH.—Oil Cities Utilities Company. Capital, $3,500,000. Incorporators: S. P. Hill, W. R. Hill and Edward Hagmoe.

OGDEN, UTAH.—Electric Supply Company. Capital, $5,000. Incorporators: R. C. Carter, C. J. Elder, F. E. Young, A. K. Smith and J. K. Smith.

GALION, O.—North Electric Manufacturing Company. Capital, $1,000,000. Incorporators: C. H. North, Carl J. Gugler, G. C. Steele, F. W. Biehl and G. W. Dickerson.

NEW YORK, N. Y.—Hatheway & Knott. Capital, $10,000. Electrical contracting. Incorporators: G. C. Knott, G. L. Hatheway and J. A. Byrne, 120 Liberty Street, New York City.

WILMINGTON, DEL.—Economic Electric Company. Capital, $500,000. Manufacture electric machines, storage batteries, etc. Incorporators: K. M. Dougherty, C. Fearon and E. Lynch.

NEW YORK, N. Y.—Satrobin Electrical Supply Company Capital, $30,000. Electrical fixtures and supplies. Incorporators: M. and S. Levine and J. Satrobin, 860 West 162nd Street, New York City.

COLUMBUS, O.—The Fisher-Chase Manufacturing Company. Capital, $10,000. Manufacture electrical devices. Incorporators: O. L. Chase, H. F. Fisher, J. H. Grier, R. W. Jones and J. L. Gleich.

NEW YORK, N. Y.—Brushlite Company. Capital, $10,000. Manufacture motors and electrical machinery. Incorporators: H. A. Fluckinger, F. M. Van Wagonen and P. S. Hill, 27 Pine Street, New York City.

CARROLL, IOWA.—Consumers' Electrician Company Capital, $50,000. Electrical contracting, repairs, etc. Incorporators: F. C. Ross and C. C. Helmer, of Carroll and C. H. Ulter, of Grinnell, Iowa.

NEW YORK, N. Y.—International Port-o-Phone Sales Corporation. Capital, $100,000. Manufacture electric devices for defective hearing, etc. Incorporators: C. C. Kelley, E. W. Seymour and Donn Wood, all of 115 Broadway, New York City.

Financial Notes

The operating revenues of the Reading (Pa.) Transit & Light Company and subsidiary companies for the month of March, 1917, were $243,539, an increase of $42,722 or 21.27 per cent over March, 1916. This increase is divided evenly between the railway and electric departments.

The Iowa Southern Utilities Company, of Centerville, Iowa, has asked the State Executive Council for authority to buy and issue stock for five properties in Southern Iowa, valued at $340,000. The plants are located at Leon, Mount Ayr, Lenox, Clearfield and Blockton.

The gross income of the Consolidated Gas Electric Light and Power Company, of Baltimore, increased $111,313.54 for February, as compared with the same month of 1916. Total gross income was $745,350.91. The net income of the property was $217,144.14, or $37,726.15 greater than for February of last year. Surplus for the month was $93,619.15, a gain of $15,068.64.

The Colorado Power Company has announced the election of new directors as follows: Charles J. Paine, of Boston; C. N. Mason, vice-president of the Electrical Securities Corporation; Edward D. Page, of New York, and George E. Claflin, vice-president of the Electric Bond & Share Company, to succeed A. C. Bedford, I. W. Bonbright, J. R. McKee and F. C. Walcott. The other retiring directors were re-elected.

A report of the reorganization committee of the Northern Idaho & Montana Power Company shows that on March 30, a total of $3,833,000 par value of bonds had been deposited under the reorganization plan, which is an aggregate of more than 83 per cent of the outstanding bonds. There had also been deposited in excess of 55 per cent of the outstanding preferred and in excess of 66 per cent of the outstanding common stock. Feeling that there is a considerable amount of securities of the company which have not been deposited owing to delays in foreign countries and to deaths of holders, the original time for deposit (April 1) has been extended to June 1.

Plans for financing the electric power corporation designed to take over the Lehigh Navigation Electric, Lehigh Valley Transit and Northern Central companies, and to

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. Rate Per cent	Bid Apr. 2	Bid Apr. 9
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	....	26	26
Adirondack Electric Power of Glens Falls, preferred	6	82½	82¼
American Gas & Electric of New York, common	10+extra	137	137
American Gas & Electric of New York, preferred	6	51	50¾
American Light & Traction of New York, common	....	360	358
American Light & Traction of New York, preferred	6	112	112
American Power & Light of New York, common	4	84	84
American Power & Light of New York, preferred	6	89	88½
American Public Utilities of Grand Rapids, common	....	36	37
American Public Utilities of Grand Rapids, preferred	6	69	67
American Telephone & Telegraph of New York	....	125	123⅝
American Water Works & Elec. of New York, common	....	12¼	12
American Water Works & Elec. of New York, particip	7	31	31
American Water Works & Elec. of New York, first preferred	....	80	81
Appalachian Power of Bluefield, common	....	6½	6¼
Appalachian Power of Bluefield, preferred	7	37	37
Cities Service of New York, common	6+extra	292	287
Cities Service of New York, preferred	6	89¾	88½
Commonwealth Edison of Chicago	8	137	135
Comm. Power, Railway & Light of Jackson, common	4	57	55
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	....	12½	12½
Federal Light & Traction of New York, preferred	....	50	50
Illinois Northern Utilities of Dixon	6	80	80
Middle West Utilities of Chicago, common	2+2 extra	58	57
Middle West Utilities of Chicago, preferred	6	77½	77½
Northern States Power of Chicago, common	7	98¾	97
Northern States Power of Chicago, preferred	7	98¾	98
Pacific Gas & Electric of San Francisco, common	5	64¾	62¾
Pacific Gas & Electric of San Francisco, preferred	6	91	92
Public Service of Northern Illinois, Chicago, common	7	110	108
Public Service of Northern Illinois, Chicago, preferred	6	101½	100
Republic Railway & Light of Youngstown, common	4	37½	37
Republic Railway & Light of Youngstown, preferred	6	69	67
Standard Gas & Electric of Chicago, common	....	12¾	12½
Standard Gas & Electric of Chicago, preferred	6	39½	39
Tennessee Railway, Light & Power of Chattanooga, common	....	7½	6½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	34	32
United Light & Railways of Grand Rapids, common	4	47	46
United Light & Railways of Grand Rapids, preferred	6	75	74½
Western Power of San Francisco, common	....	15	15
Western Power of San Francisco, preferred	6	60	60
Western Union Telegraph of New York	5+ extra	97	96
Industrials—			
Electric Storage Battery of Philadelphia, common	4	63	62½
General Electric of Schenectady	8	165½	161½
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†135	†135
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	52½	48
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	79	67

†Last Sale.

develop the electric business in the anthracite region and contiguous territory, have been worked out ready to be given effect when remaining details in the proposition shall be arranged. There will be a $40,000,000 collateral trust, purchase money issue, running ten years and bearing six per cent on the amount paid in on the obligations. These collateral trust certificates will be sold with a first assessment called, either 10 or 20 per cent, buyers getting a bonus in common stock of the new power corporation, and being accorded the privilege of paying up to the par of the certificates should they desire to put in the uncalled balance to get six per cent on that much more capital investment and to be free of the assessment liability. Assuming all the Lehigh Valley Transit stock shall be turned over, about $8,000,000 cash will be required to pay for it and the Northern Central stock already bought. As the consolidation proceeds and the underlying securities are acquired or retired by the electric power corporation, additional capital will be obtained, as required, by assessments on the collateral trust obligations, which, through such operations, will come steadily closer to having a first lien on the properties. Ultimately they are to be paid, when first and refunding mortgage bonds can be issued. It is expected that another month will see the project ready to launch.

Reports of Earnings.

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company has issued a comparative earnings report for the three months ending March 31, 1916, and 1917, (Month of March, 1917, estimated) as follows:

	1917	1916
Total revenues	$17,132,187	$14,350,613
Maintenance repairs, and reserved for depreciation	1,928,460	1,856,957
Other operating expenses, including rent of leased lines and taxes	10,983,844	8,956,092
Total expenses	12,912,304	10,813,049
Balance	4,219,883	3,537,564
Interest on bonded debt	332,963	332,963
Net income	3,886,920	3,204,601

APPALACHIAN POWER.

The Appalachian Power Company has issued a comparative statement of earnings and expenses for February and for the 12 months ending February 28 as follows:

February—	1917	1916
Gross earnings	$67,749	$61,264
Operating expenses and taxes	30,540	27,960
Net earnings	37,209	33,304
Total income	37,221	33,764
Twelve months—		
Gross earnings	814,173	660,151
Operating expenses and taxes	359,810	314,384
Net earnings	454,363	345,767
Total income	458,166	346,227
Bond interest	280,416	272,500
Note interest	159,051	151,214
General interest	13,291	8,074
Net income	5,408	60,910

Proposals

GOVERNMENT WORK ON TERRESTRIAL MAGNETISM.—A paper entitled "The Work Done by the United States Coast and Geodetic Survey in the Field of Terrestrial Magnetism," prepared by Dr. L. A. Bauer, has been published as a 14-page reprint. It summarizes the work in this field that has been done by the various expeditions carried on by the Coast and Geodetic Survey, Washington, D. C.

COMBUSITION IN HAND-FIRED FURNACES.—The Bureau of Mines, Washington, D. C., has published technical paper 137, entitled "Combustion in the Fuel Bed in Hand-Fired Furnaces." This is a report on investigations of this subject carried on by H. Kreisinger, F. K. Ovitz and C. E. Augustine. The paper is well illustrated and gives many valuable suggestions for improving the efficiency of boiler furnaces.

CARNEGIE INSTITUTION WORK ON TERRESTRIAL MAGNETISM.—The annual report of the Department of Terrestrial Magnetism, of the Carnegie Institution of Washington, D. C., covering the work carried on during 1916, has been published. It gives a general summary of the work done in magnetic surveys and investigations which have been carried out in various parts of the world by the institution's two special magnetic-survey vessels.

Electrical Patents Issued April 3, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,221,013. **Ventilating Plate and Spacer for Electrical Apparatus.** G. B. Auel, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., Spacing finger for laminated structures.

1,221,030. **Telephone System.** H. D. Currier, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement of cord and trunk circuits, operators' sets, etc.

1,221,032. **Local Fire-Alarm System.** D. G. Dee, assignor to R. H. Rogers, Rochester, N. Y. Arrangement of alarm and test circuits for alarm and test batteries.

1,221,033. **Wireless-Telegraph Signaling System.** L. De Forest, assignor to Radio Telephone & Telegraph Co., New York, N. Y. For multiplex signaling.

1,221,034. **Oscillating Current generator.** L. De Forest, assignor to De Forest Radio Telephone & Telegraph Co. Arrangement comprising a vapor arc.

1,221,035. **Apparatus for Use in Wire or Radio Communication.** L. De Forest, assignor to Radio Telephone & Telegraph Co., New York, N. Y. Receiving system comprising a normally oscillating audion.

1,221,039. **Flame-Arc Lamp and Electrode Therefor.** G. Egly, assignor to Gebrueder Siemens & Co., Berlin-Treptow, Germany. Negative electrode contains boracic acid as slag forming preventive.

1,221,050. **Circuit-Interrupting System.** A. L. Harvey, assignor to Westinghouse Electric & Mfg. Co. Interlocking switch grouping for connecting any one of several transformers to any one of several circuits, but connecting of transformers in parallel on any one circuit is prevented.

1,1221,059. **Hanger for Light-Reflecting Bowls.** C. E. Jones, assignor to Metal Arts & Crafts Co., Chicago, Ill. Structural details of bowl-engaging clamp.

1,221,061 and 1,221,062. **Galvanic Cell.** M. L. Kaplan, assignor to Beacon Miniature Electric Co., Inc., New York, N. Y. First patent: Process of preparing manganese peroxid for use in Leclanche cells. Second patent: Composition of depolarizing agent for miniature dry cell, containing above mixed with carbon.

1,221,063. **Flashlight-Ignition System for Cameras.** C. A. Lare, Eugene, Ore. Details of circuit for flash ignition.

1,221,095. **Means for Collectively Actuating and Controlling Alternating-Current Motors.** J. L. Routin, Paris, France. Stators and rotors of compensated, commutator motors are respectively connected with the phases of a two-phase generator and the voltage and phase difference of the phases are varied.

1,221,106. **Electric Water-Heater.** E. Stranszky, New York, N. Y. Structure of water chamber and mounting of heater coils therein.

1,221,124. **Machine-Switching Telephone-Exchange System.** S. B. Williams, Jr., assignor to Western Electric Co., New York, N. Y. Details of senders, selectors, etc., with appurtenant circuits.

1,221,134. **Secrecy System for Extension and Party-Line Telephones.** C. C. Bradbury, assignor to Western Electric Co. Each station has key for isolating all other stations from line.

1,221,135. **Telephone System.** O. Brisbois, assignor to J. H. Ware, Chicago, Ill. Prepayment arrangements.

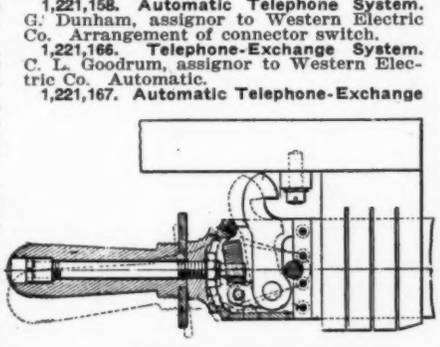
1,221,139. **Apparatus and Method for Producing Metals of Improved Quality.** H. M. Chance, Philadelphia, Pa. Blast furnace has provision for passing current through the fused metal and slag.

1,221,140. **Telephone Signaling System.** H. P. Clausen, assignor to Western Electric Co. Arrangement of line annunciators on multi-section board.

1,221,158. **Automatic Telephone System.** G. Dunham, assignor to Western Electric Co. Arrangement of connector switch.

1,221,166. **Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co. Automatic.

1,221,167. **Automatic Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co. Arrangement of stepping relays and release magnets.



No. 1,221,611.—Locking-Switch.

1,221,168. **Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co. Arrangement and structure of automatic selector switch with relation to telephone lines and trunks.

1,221,169. **Machine-Switching Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co. For combination of restricted and non-restricted lines.

1,221,177. **Selectively Operated System.** R. N. Hill, assignor to Western Electric Co. Circuit-breakers at several power stations are remotely and selectively controlled from a central station.

1,221,182. **Telephone-Exchange System.** L. H. Johnson, assignor to Western Electric Co. Special arrangement of line signal.

1,221,188. **Quadruplex Telegraphy.** I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. Has alternations of high voltage for no signal, of different voltages for one signal and none for two signals.

1,221,191. **Apparatus for Checking a Number of Telephone Calls.** E. Kolossvary, assignor to Western Electric Co. Telephone hand-set, including a register, for inserting in a telephone circuit.

1,221,206. **Electrolyzing Apparatus.** R. J. J. Mueller, assignor to Universal Oxygen Co., Sheboygan, Wis. Tank is one polarity and cover of other polarity with special mounting and structure of diaphragm.

1,221,208. **Magneto.** A. H. Neuland, assignor to Neuland Magneto Co., San Francisco, Cal. High tension and frequency; magnetic structure maintaining flux path of constant reluctance and reversing the generating flux which is parallel to the shaft.

1,221,216. **Time-Controlled Switch.** G. H. Pyper, Midvale, Utah. Manually set, clock operated.

1,221,232. **Automatic Cutout.** J. M. Sherman, Seattle, Wash. Details of inclosed fuse.

1,221,235. **Subscriber's Telephone-Circuit.** A. B. Smith, assignor to Automatic Electric Co., Chicago, Ill. Arrangement of subscriber's set and impulse-sender for automatic system.

1,221,238. **Phantom-Circuit Loading.** J. B. Speed, assignor to Western Electric Co. Structure of core and windings of coil for use as loading unit or two physical circuits and a derived phantom circuit.

1,221,239. **Electrical Connector.** C. E. Stahl and J. F. Cavanagh, assignors to Connecticut Telephone & Electric Co., Meriden, Conn. Plug and socket structure for insulated wire.

1,221,255. **Connector-Socket for Electric Lamps or the Like.** R. H. Welles, assignor to Badger Brass Mfg. Co., Kenosha, Wis. Structure of device for use in headlight and adapted to receive an Ediswan base.

1,221,260. **Insulated Rail-Joint.** B. Wolhaupter and B. G. Braine, assignors to Rail Joint Co., New York, N. Y. Details of splice-bar insulation.

1,221,262. **Telephone-Exchange System.** J. L. Wright, assignor to Western Electric Co. Automatic system wherein the exchange connections are effected by currents of high and low frequency, respectively, transmitted from subscribers' stations.

1,221,267. **Electric Saw.** S. A. Anderson, Jr., Louisville, Ky. Gearing and mounting of motor-driven swing-saw.

1,221,270. **Thermocouple.** J. W. Bard, assignor to Sangamo Electric Co., Springfield, Ill. Special structure of two dissimilar integral metal members.

1,221,275. **Cartridge Fuse.** W. F. Bleecker, Washington, Pa. Fuse has threaded sockets engaging with screws secured in end caps.

1,221,287. **Automatic Telephone Trunking-Switch and System Therefor.** W. L. Campbell, assignor to Automatic Electric Co. Relates to operation of non-numerical trunking switches individual to the subscribers' lines.

1,221,299. **Semi-Automatic Telephone System.** C. J. Erickson, assignor to Automatic Electric Co. Has special busy test and operators' signal.

1,221,308. **Apparatus for Transmitting Impulses of Current in Electric Circuits.** C. L. Goodrum and B. G. Dunham, as-

signors to Western Electric Co. Details of impulse transmitter for automatic telephone circuits.

1,221,309. Automatic Train-Control System. E. W. Gorsuch, Baltimore, Md. Operation of valves by shoe is electrically controlled.

1,221,310. Shoe Structure for Train-Control Systems. E. W. Gorsuch. For use with above.

1,221,311. Apparatus for Obtaining Direct Currents from Alternating Currents. L. B. Graham, East Chicago, Ind., assignor of one-third to himself, one-third to A. H. Adams, Oak Park, Ill., and one-third to J. L. Jackson, River Forest, Ill. Arrangement of electrically controlled asymmetric resistances.

1,221,322. Electric Lock. S. B. Hess, New York, N. Y. Lock is electromagnetically operated.

1,221,325. Electric Switch. M. Hoffman, Ivanhoe, Minn., assignor of one-half to W. J. Dalton and one-sixth to F. R. Kluezny, Ivanhoe, Minn. Details of structure operated by rotatable knob.

1,221,326. Apparatus for Adjusting the Period of Electrical Ignition. G. Honold, assignor to firm of Robert Bosch, Stuttgart, Germany. Centrifugally controlled.

1,221,327. Electrical Regulating Device. G. Honold, assignor to firm of Robert Bosch. Details of electromagnetically adjusted compression resistance.

1,221,345. Controller. W. A. Marschke and F. W. Marschke, Indianapolis, Ind. Starter for electric motors.

1,221,346. Automatic Telephone Switching Apparatus. T. G. Martin, assignor to Automatic Electric Co. Structural details of automatic switch.

1,221,377. Signaling Mechanism. H. E. Reeve, New York, N. Y. Electromechanical gong.

1,221,391. Feeding Device. L. H. Thullen, Brooklyn, N. Y. Motors driving a working device toward its work are controlled according to the resistance encountered by the device.

1,221,404. Telephone System. W. Aitken, London, England. Arrangement of cord circuits in a common-battery manual system.

1,221,407. Apparatus for Producing Companion Auditory and Visual Records for Simultaneous Reproduction. E. H. Amet, Redondo Beach, Cal. Combination of moving-picture and sound-recording machines, the latter having telephonic means for receiving sound and transmitting it to the record.

1,221,408. Means for Reproducing Vibrations. E. H. Amet. Structure of telephonic means of above.

1,221,409. Construction of Electrically Driven Cloth-Cutting Machines. M. Arendt, assignor to H. Maimin Co., Inc., New York, N. Y. Structure of portable motor of commutator type.

1,221,418. Incandescent Light for Projection Apparatus. E. L. Clark, assignor to National Carbon Co., Cleveland, O. Bulb has greater part of surface reflecting and remainder forms a window.

1,221,439. Telephone System. E. G. Godfree, Sandringham, near Melbourne, Victoria, Australia. Has call meters at substations and also at central.

1,221,443. System for Recording Meter Operations. C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Electromagnetically controlled apparatus for recording the actuations of a number of meters.

1,221,451. Controller Device for Electric Lighting and Heating Purposes. F. H. Hoffman, assignor to Williams, Brown & Earle, Philadelphia, Pa. Two sets of circuits, one with resistances and the other with heating coils may be connected at will by double-pole switches, with line so that lamps are not interfered with.

1,221,486. Circuit-Closer. J. W. Stutts, Florence, Ala. Structure of thermostatically controlled device.

1,221,499. Electric Switch. P. H. Zimmer, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Structure of circuit-breaker with solenoid operated arm and an overload magnetic trip connecting the solenoid plunger and arm.

1,221,505. Method of Separating Certain Constituents from a Gas or Mixture of Gases. L. Bradley and W. A. Schmidt, assignors to Research Corp., New York, N. Y. Gas is absorbed by particles suspended in mixture which are then precipitated by subjecting the gas to an electric field.

1,221,512. Electric Welding Apparatus. J. P. Cluley, Green Bay, Wis. Details of resistance-type machine; structure of workholders, fluid-cooled handles, etc.

1,221,527. Elevator-Signal. R. H. Gaylord, assignor to R. H. Gaylord Co., Los Angeles, Cal. Selective signal transmitters for different cars send impulses according to up or down motion and a single receiver on each floor receives all signals.

1,221,538. Signal Apparatus. G. Jackson, Jr., Hohokus, N. J. For railways.

1,221,547. Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. Method of diplexing lines of transmission.

1,221,560. Electric Meter. E. H. Messiter, assignor to Electric Weighing Co., New York, N. Y. Manner of adjusting magnetic damping mechanism of motor device.

1,221,590. Indicating Electric Switch. J. Rado, Cleveland, O. Indicating lamp in push button of switch is lighted when switch is in "off" position.

1,221,607. Mount for Magneto Distributers. E. J. J. Salmson, assignor to Societe Des Moteurs Salmson, Billancourt, France. Structure of brush-holder and manner of securing it to shaft.

1,221,609. Automatic Switch. E. H. Schwarz, assignor to General Electric Co., Schenectady, N. Y. Special arrangment of underset toggle controlled by electromagnetic latch, for actuating oil switch.

1,221,611. Locking-Switch. E. O. Sessions, Chicago, Chicago, Ill. Latch for holding knife-blade closed is actuated by switch-handle when operated to open switch. (See cut, previous page.)

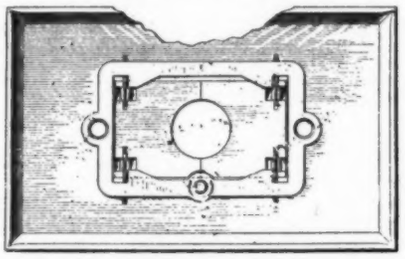
1,221,621. Signaling Apparatus. W. H. Stevens, Altoona, Pa. Sounds are transmitted through train air pipe and electromagnetically reproduced.

1,221,633. Internal-Combustion Engine. W. H. Upton and H. C. Stoll, New York. Has special mounting of ignition device.

1,221,647. Electrode of Metallic Vapor-Rectifiers or Other Apparatus. A. A. Baden, assignor to Aktiengesellschaft Brown Boveri & Cie, Baden, Switzerland. Rectifier comprises a metal well with an insulated anode projecting on both sides and comprising a single, sealed metal tube containing mercury under diminished pressure.

1,221,652. Face-Plate for Flush Receptacles. H. U. Badeau, assignor to Bryant Electric Co., Bridgeport, Conn. Relates to structural details of hinged door. (See cut.)

1,221,657. Dynamoelectric Machine. S. R. Bergman, assignor to General Electric Co.



No. 1,221,652.—Face-Plate for Flush Receptacles.

Variable-speed, commutator machine for charging or operating from a storage battery.

1,221,674. Train-Signal. A. Capitan, David, Canal Zone. Structure of circuit-closure having contacts held apart by destructible means.

1,221,675. Pneumatically Operated Cam-Controller. F. E. Case, assignor to General Electric Co. Means for controlling motors comprising a number of unit switches.

1,221,678. Telephone Desk-Set. C. L. Chisholm, St. Mary's, New Brunswick, Canada, assignor to Chisholm Transmitter & Telephone Instruments Co. Structural details.

1,221,681. Electrical Horsepower-Computing Machine. B. E. Clough, Battle Creek, Mich. Mechanical driving connection operates rheostats in wattmeter circuits.

1,221,730. Egg-Inspecting Machine. M. R. Hatfield, Wichita, Kans. Details of mechanism for successively passing the eggs through a sight box.

1,221,744. Shade-Holder. H. Kienzle, New York, N. Y. Mounting of lamp socket and globe holder on hollow lamp standard.

1,221,753. Electric Locomotive. C. W. Larson, assignor to General Electric Co. Traction motor is operated from trolley or storage battery and battery is charged from trolley by motor-generator set.

1,221,762. Current-Collector for Electric Cars. J. McMillan, Glendale, and C. V. Greenamyer, Los Angeles, Cal. Contactor is pressed against trolley by pneumatically operated toggle.

1,221,763. Trolley. J. McMillan and C. V. Greenamyer. Structure of trolley harp guard for preventing axle ends from engaging span wires when wheel jumps trolley.

1,221,773. Telephone-Exchange System. A. B. Sperry, assignor to Western Electric Co. Automatic system wherein a third line may be connected in the talking circuit.

1,221,780. Photo Telegraphic Machine. G. Wald, U. S. Army. Method of reproducing pictures by electric impulses.

1,221,784. Receiver-Holding Attachment for Telephones. J. F. Williams, New York, N. Y. Details of extended arm on telephone desk-set.

1,221,787. Apparatus for Directed Wireless Telegraphy and Telephony. E. Bellini, Enghien-les-Bains, France. Arrangement of antennae and plates and a rotary system of plates connected to a high frequency apparatus.

1,221,801. Selective Signaling System. J. A. Hulit, assignor to Automatic Electric Co. Arrangement of circuits in combination with a special code impulse sending device.

Reissue 14,280. Temperature-Compensating Device for Thermoelectric Measuring Instruments. W. H. Bristol, assignor to Bristol Co., Waterbury, Conn. Consists of a resistance in a liquid in a thermometric device; for use in conjunction with a thermoelectric generator used as a pyrometer.

Reissue 14,282. Power-Transmission System. W. Morrison, assignor to Vesta Accumulator Co., Chicago, Ill. Gas engine has power connection through dynamoelectric ciutch having both armature and field rotating, the controls of the clutch and engine being specially interrelated.

PATENTS EXPIRED.

The following United States electrical patents expired on April 10, 1917:

646,963. House-Telephone System. F. M. Dunn, Baltimore, Md.

647,006. Special Apparatus for Electric Baths. A. Maggiorani, Rome, Italy.

647,007, 647,008 and 647,009. Apparatus Employed in Wireless Telegraphy. G. Marconi, London, England.

647,016. Pressure Regulator for Commutator Brushes. J. O. Moisson, Charleston, S. C.

647,023 to 647,026. Heating System. A. G. Paul, Boston, Mass.

647,031. Electric Arc Lamp. J. Rosemeyer, Lingen-on-the-Ems, Germany.

647,071. Electric Indicator for Doors. R. H. Boardman, New Britain, Conn.

647,085. Secondary Battery. H. S. Gladstone, London, England.

647,097. Railway Signal. J. Jorgenson, San Francisco, Cal.

647,101. Battery Case for Electromedical Apparatus. J. H. Mahler and C. F. Dunderdale, Chicago, Ill.

647,142. Brake Mechanism for Electrical Cars. U. E. Maille, Providence, R. I.

647,155. Automatic Switch for Electric Car-Lighting Apparatus. W. F. Richards, Buffalo, N. Y.

647,168. Safety Appliance for Electric Circuits. E. Thomson, Swampscott, Mass.

647,175. Transmission of Electrical Impulses. F. Bedell, Ithaca, N. Y.

647,177. Storage-Battery Tank. Rufus N. Chamberlain, Depew, N. Y.

647,184. Electric Headlight. W. S. Hamm, Chicago, Ill.

647,193. Trolley. J. B. Lynch, Waverly, and G. B. Griffin and J. A. Simpson, Elmira, N. Y.

647,210. Electromagnetic Engine. P. B. Watson, Philadelphia, Pa.

647,217. Electrolyzing Apparatus. A. J. O. Chalandre, L. J. B. A. Colas and C. J. Gerard, Paris, France.

247,219. Electric Arc Lamp. W. J. Cochran, LeRoy, N. Y.

647,224. Indicator for Railways. R. H. Forde, New York, N. Y.

647,240. Electrically Driven Mechanism. F. J. Sprague, New York, N. Y.

647,241. Brake for Hoisting Mechanism. F. J. Sprague, New York, N. Y.

647,250. Electric Metal-Working Apparatus. C. L. Coffin, Detroit, Mich.

647,251. Storage-Battery Suspension for Motor Vehicles. G. H. Condict, New York, N. Y.

647,254. Centrifugal Electric Switch. E. Cros, Paris, France.

647,300. Telephone Signaling System. N. H. Holland, Brookline, Mass.

647,307. Combined Telephone-Exchange and Fire-Alarm System. J. M. Latimer, Philadelphia, Pa.

647,309. Electric Clock. A. Lungen, New York, N. Y.

647,364. Electrical Gas-Lighter. H. R. Bennett, San Francisco, Cal.

647,414. Electric Switch. W. F. Jones, London, England.

647,426. Secondary-Battery Plate and Process of Manufacturing Same. P. G. Salom, Philadelphia, Pa.

647,434. Electric Arc Lamp. R. E. Ball, New York, N. Y.

647,436. Automatic Brake for Electric Motors. M. A. Beck, Milwaukee, Wis.

647,442. Secondary Battery. C. J. Coleman, Chicago, Ill.

647,454. Electromagnetic Traction Apparatus for Street Cars. G. N. Moore, New York, N. Y.

Design 32,507. Portable Electric-Lamp Body. J. S. Meade, Buffalo, N. Y.